ELECTRICAL REVIEW

11th SEPTEMBER, 1953

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VOL. 153: No. 11
Eighty-First Year
Fridays: Price 1/-

EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.O.s (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed "Lloyds Bank."

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2.

3.

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3. *4′ 0″ square double sided illuminated total load indicator.*

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ELECTRICAL REVIEW 11th SEPTEMBER, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. 153 • NO. 11

Waste of Energy

ONE of the valuable features of the Ridley Report, published twelve months ago, was that it disposed of certain controversies concerning the best use of fuel in the public interest. The Committee rejected the idea of setting up a super-planning authority to control the work of the three main supply services—coal, electricity and gas. It also rejected the suggestion that the supply of electricity should be limited to defined purposes; it held that competition in providing the services most acceptable to consumers, allowing them full freedom of choice, promoted efficiency as well as satisfying British traditions.

These conclusions of a committee of people eminent in many fields, who had opportunities of weighing evidence submitted by the three authorities concerned, have not met with the approval of a team of specialists in factory fuel technology (which included no electrical engineer) who visited the United States last year to study fuel conservation methods there. Possibly because fuel resources do not present the problem in America that they do here, very few of the forty recommendations made appear to be more than expressions of opinion which might well have been entertained without travelling abroad. There is, of course, much of technical interest in the report (reviewed on page 561) regarding individual installations in Britain as well as in the United States. Allowing for the present use of private back-pressure plants in appropriate cases in either country, expectations apparently held of future contributions to electrical output from this source seem unduly optimistic. The strictures on the use of electricity for space heating are not relevant to fuel conservation and are inconsistent with the reference in the report to the seriously diminishing reserves of carbonizing coal for making gas, as compared with the low-grade slacks burned in electric power stations. The main proposal of the team is the setting up of still another Government Commission to formulate a national policy more to its liking, including the establish-

ment of a non-political Fuel and Power Board. But surely political control by an appropriate Minister is necessary to safeguard the national interest in so important a basis of industrial life as fuel. Actual co-operation between the three services, as and when necessary, already exists, and the expressed view of the Minister of Fuel and Power (Mr. Geoffrey Lloyd), whose function it is to co-ordinate their working, is that the national purpose is most truly served through his joint consultations with the heads of these industries. In our view that is the most practical method.

THE " OVERLORDS " DEPART

When the Prime Minister decided about two years ago to appoint certain " co-ordinating " Ministers to exercise unspecified supervisory powers over groups of Government Departments we questioned the wisdom of such a step. It was likely, we thought, to impose still more uncertainty upon those who actually had to operate the services involved. Our concern was particularly with the transport, fuel and power services over which Lord Leathers was placed. Now these " overlordships " have been brought to an end. In a polite exchange of notes between the Prime Minister and these Ministers there have been references to their achievements, but so far as fuel and power are concerned we have noticed little if any effect.

CLEVER TACTICS

Those who are inclined to think that there may be some justice in the Electrical Trades Union's claim for higher wages for its members in the contracting industry are likely to be alienated by the methods which the Union has adopted to enforce its demand. As we said last week, it was reasonable for the National Federated Electrical Association to desire time to consult its members on the re-opening of a claim which had been rejected. The Union has made a personal matter of this by calling out the employees of members of the N.F.E.A. executive committee. This is a form of spitefulness calculated to make further negotiations difficult, if not impossible. No doubt the piecemeal strike method adopted by the E.T.U. is clever, but cleverness carried to such lengths becomes objectionable not only to the people it is aimed at but also to the men called out who are equally victims of such a policy.

INDEPENDENT ACTION

The situation has been rendered more difficult by the action of Earls Court, Ltd., which, anxious to ensure the success of the Radio Show, decided to pay electricians working on the stands an extra 3d an hour. Apart from the fact that this increase probably exceeds the Union's expectations, such an " emergency " concession throws orderly wage negotiations out of gear. Admittedly the Earls Court Company is not a member of the N.F.E.A. but hitherto it has observed the conditions negotiated by the Association with the E.T.U. The Union is likely to contend that what one employer does in an emergency can be generally applied to normal working.

BOLD POLICY NEEDED

Electrical equipment forms an increasing proportion of the products displayed at the biennial Engineering, Marine and Welding Exhibition and it was therefore appropriate that this year's event—the largest of the series —should be opened by Mr. D. D. Walker, chairman of the B.E.A.M.A. Speaking of the task confronting the engineering industry in expanding our export trade he said that the Exhibition contained many examples of products in which we led the world; the need to-day was for boldness in selling in the face of growing competition. Support is given to this point in the Treasury's latest *Bulletin for Industry* which shows that there are a number of markets in which our share of the trade is less than before the war.

Transformer Steels

Their Choice and Present State of Development

By

C. D. MEE,

Ph.D., A.Inst.P.*

OF the many available ferromagnetic alloys, one may wonder why those containing about 4 per cent of silicon in iron are used almost exclusively for power transformers. This article reviews the general considerations governing the choice and indicates the present state of development of transformer steels. The basic factors limiting the magnetic performance of silicon-iron alloys are discussed, in an attempt to throw light on the attributes of magnetic softness and hence to indicate lines for improvement. It must be said at the outset that magnetic properties alone do not decide which alloys have the greatest technological importance. A foremost consideration in choosing material for power transformers is that it must be available in large quantities. This immediately narrows the field to using iron as the chief constituent, since, other things being approximately equal, iron is the cheapest and most readily available ferromagnetic element. The final choice of alloying elements depends on many factors of which cost of material always takes an important place. Mechanical properties of the final alloy are also very important and, as will be seen later, represent a limiting factor on future development.

Magnetically suitable alloys have low specific resistivities, and so power transformer cores are made up of thin laminations to restrict the flow of electric currents in the core material. Thus, in order to handle and cut thin sheets successfully and also to make full use of core space, the material must not be excessively brittle, and a good surface finish is called for. Some heating of a transformer core is inevitable, and so the temperature stability of sheet properties must be considered.

The above economic and mechanical limitations must be considered in their correct perspective along with the required magnetic properties. These desirable magnetic properties will now be briefly described.

The power transformer designer requires his core material to have the lowest possible energy losses at a high value of working flux density. Once the chemical composition of the material has been decided, the sheet manufacturer has no control over the saturation induction, but he can greatly influence the energy loss by his processing methods. Hence saturation induction must be considered first. Fortunately, of the three ferromagnetic elements in use, iron has the highest saturation induction, cobalt is slightly lower and nickel about one-third of the cobalt value. Apart from cobalt and nickel, all common alloying elements lower the saturation induction. Cobalt does in fact give an appreciable increase to this quantity and cobalt-iron alloys find commercial application in diaphragms for telephone receivers and for aircraft power generators, where the saving in weight of material for a given induction is of primary importance. The high cost of cobalt does, however, restrict its use as a suitable alloying element for power transformer cores. Nickel-iron alloys are also expensive, but where a high saturation induction is not essential they offer remarkable magnetic properties of high permeability and low losses and find many commercial applications.

Following the rejection of ferromagnetic alloying elements for reasons of high cost, the effect of small additions of other elements will be considered. Immediate reduction in losses due to eddy currents results from the higher resistivities usually obtained from the addition of alloying elements. Silicon and aluminium are especially beneficial in this respect. However, the highest component of the core losses is due to magnetic hysteresis and this accounts for some 80 per cent of the losses in present-day high grade isotropic

* Steel Company of Wales, Ltd., Lysaght Division.

transformer steel. It has been found that addition of silicon to iron up to 4·5 per cent has greatly reduced the hysteresis loss. Reduction of total losses and virtual elimination of magnetic ageing has commended silicon as the best all-round alloying element for transformer steels. The manner in which losses occur and are reduced will now be discussed in greater detail.

Hysteresis loss is a measure of the opposition which a material presents to gradual changes in its state of magnetization. To understand this more fully, a brief statement of the processes of magnetization is required. Ferromagnetic materials are at all times magnetized to the saturation value determined by their chemical composition and temperature. The direction of this magnetization changes throughout the material and the regions in which it is unidirectional are called domains. In a specimen which appears to be demagnetized the total fluxes of all the domains cancel out.

A possible appearance of domains in a polycrystalline material is drawn in Fig. 1. Note that in each grain, four directions of magnetization at most, and usually only two, are indicated. This is because in cubic crystals like Si-Fe, six perpendicular directions are very much softer magnetically and are called directions of easy magnetization; in the upper grain of the picture, four of these easy directions occur in the plane of the paper. There are two processes of magnetization. Consider the domains marked A, B and C in Fig. 1. If a magnetic field is applied from south to north of Fig. 1, then domain A will grow at the expense of domains B and C, the boundaries between the domains being displaced.

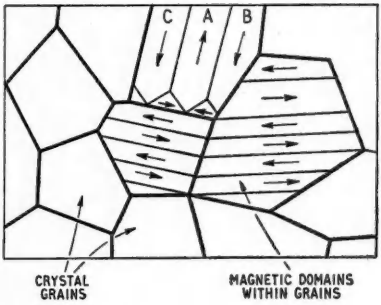


Fig. 1.—Grain crystals showing magnetic domains within the grains. The heavy lines indicate grain boundaries and the light lines domain boundaries

This type of magnetization is responsible for the steep part of the B-H curve. At higher applied fields when domain A has enveloped domains B and C, the direction of magnetization of domain A will rotate towards the applied field direction and so will point vertically upwards. In the case

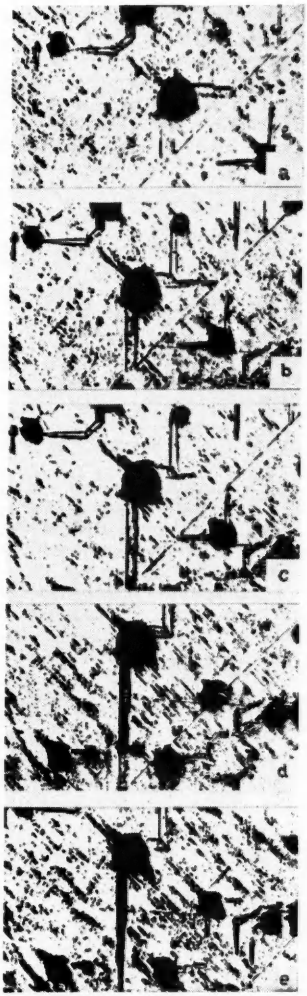


Fig. 2.—These photographs of a small area of the surface of a 3 per cent Si-Fe crystal show how inhomogeneity can impede the motion of a domain wall

of silicon-iron this second process of magnetization requires a large field to produce a small change in induction, and so the slope of the B-H curve is low in high fields corresponding to magnetization by domain vector rotation (see Fig. 4a). The two major improvements in losses of silicon-iron alloys are directly connected with these two processes of magnetization and will be considered separately.

From what has been said, magnetic softness is determined by the ease of domain boundary movement. This motion is impeded by inhomogeneities of composition and strain. The way in which an inhomogeneity can impede the motion of a domain wall is shown in Fig. 2, which comprises photographs of a small area of the surface of a 3 per cent Si-Fe crystal. Very fine iron particles in suspension are placed on the carefully polished and annealed surface and are attracted to the domain boundaries. In the photographs, a domain boundary running north-east to south-west is being displaced south-east by the applied field. The large black spot is a surface inhomogeneity and the boundary is moving away from this, each photograph corresponding to equal increments of applied field. Small domains, attached to the inhomogeneity, " hang on " to the boundary as illustrated in Fig. 3a (which represents Fig. 2a). When the domain boundary is finally released (Figs. 3b and 2e) it jumps forward suddenly to the bottom right-hand corner of Fig. 2e. These photographs illustrate the basic cause of hysteresis loss and the importance of removing impurities and strains. Mechanical strains are removed by annealing and further reductions of strain due to impurities result in highly superior properties. Silicon plays an important part in this latter process and reduces finely dispersed carbon in the form of cementite, and also oxygen, both of which are harmful impurities. Sulphur and nitrogen impurities also produce strains which affect magnetic softness and they are minimized by careful control during the making and processing of the alloy. High temperature annealing in an atmosphere of hydrogen also reduces impurities. This process is expensive commercially, but by annealing in pure hydrogen at over 1,300 deg C, permeabilities in pure iron have been obtained which are ten times higher than

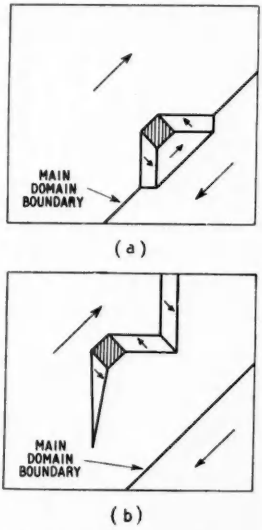
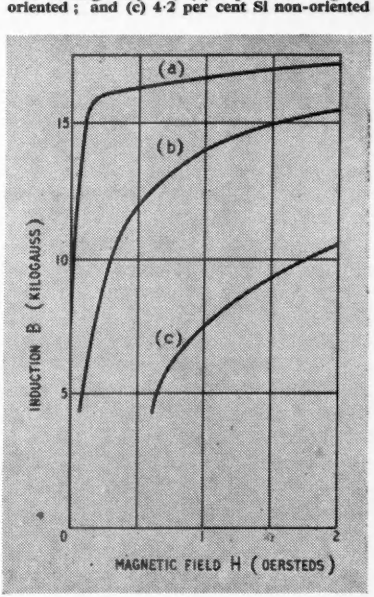


Fig. 3.—Here the shaded square represents the surface impurity shown in Fig. 2. The north-east—south-west arrows indicate main domain magnetization directions while the north-west—south-east arrows show the subsidiary domain magnetization directions

Fig. 4.—B-H curves for Si-Fe: (a) 3·85 per cent Si single crystal; (b) 3 per cent Si grain oriented; and (c) 4·2 per cent Si non-oriented



those normally found in transformer steels. Finally, the impurity content will influence the grain size obtainable, large grains being usually associated with low losses.

It will now be understood that the induction at which the slope of the B-H curve rapidly diminishes (Fig. 4a) will be determined by the change of induction resulting from domain boundary displacements. To avoid excessive magnetization currents, consequent heavy copper losses, and also distortion, the maximum working induction in a transformer core is in the region of the rapid change of slope, often called the "knee" of the curve. Hence the maximum working induction of a core is dependent on the degree of parallelism between the mean flux path in the core and the directions of easy magnetization. By a suitable sequence of cold rolling and annealing it is possible to orientate the easy directions to within a few degrees of the rolling direction, and so produce a lamination having high permeability and low hysteresis loss, particularly at high inductions. Figs. 4b and 4c show typical B-H curves for 3 per cent Si-Fe grain oriented, and 4·2 per cent Si-Fe non-oriented. For comparison, Fig. 4a shows a B-H curve for an easy direction in a single crystal of 3·8 per cent Si-Fe, which indicates the upper limit of improvement due to 100 per cent orientation and careful reduction of impurities.

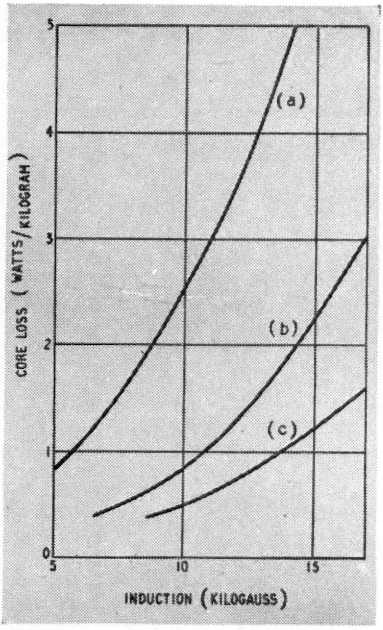


Fig. 5.—Typical core-loss curves at 50 c/s: (a) 0·4 per cent Si-Fe 0·014in thick; (b) 4·2 per cent Si-Fe 0·014in thick; and (c) 3 per cent Si-Fe 0·0125in thick, grain oriented

For the advantages of grain oriented material to be fully realized in the core of a transformer, the design must ensure that the flux is always parallel to the rolling direction, since no other easy directions of magnetization exist in the plane of the material. Special designs, in which the core is wound like a clock spring, are used, having one or two joints per turn of core material to enable pre-wound coils to be fitted. Cores of this type are now in existence in transformers of 3,300 kVA. Small transformers often use a "clock-spring" core cut into two halves (called C-cores) and losses on these cores are similar to the uncut spiral, but the gaps do give rise to increased values of exciting currents. The use of oriented material as standard E and I laminations, while inefficient, is now receiving attention, as results are claimed to be better than those obtainable from hot-rolled material. For comparison, typical total losses for 4·2 per cent Si-Fe, and 3 per cent Si-Fe grain oriented, are shown in Fig. 5. To estimate the advantage of both these materials due to silicon addition, curve (a) shows the loss characteristics of 0·4 per cent Si-Fe.

The advantageous characteristics of present-day transformer steels have now been outlined. On the debit side must be reckoned the 10 per cent lowering of saturation induction due to adding 4·2 per cent silicon to iron. In addition, a lower limit of mechanical ductility has been reached for this alloy. For the best grain oriented material only 70 per cent of the total loss is due to hysteresis plus calculated eddy currents and, to a certain extent, further improvements are hampered by a lack of understanding of the nature of this third loss component.

What, then, are the prospects for future developments of power transformer steels? The above review indicates that refinements of present techniques to produce a homogeneous highly oriented material will yield still lower losses. The development of a

oriented material having two perpendicular directions of easy magnetization in the plane of the strip would help transformer designers to get better performance from existing designs. Also, retention of a high degree of orientation for very thin strip (0·001in) would offer valuable material for transformers operating at higher frequencies than the power range.

The discovery of completely new soft magnetic alloys for power transformers is not likely, since the narrow range of economically favourable materials has already been systematically investigated. However, a study of the factors influencing magnetic softness may be fruitful in improving existing alloys. The deleterious effects of impurities and internal stresses are reduced if two magnetic quantities, magnetostriction (λ), and magnetocrystalline anisotropy (K) are reduced. These two quantities are, respectively, measures of the strain due to magnetization itself, and of the energy required to turn the direction of magnetization away from an easy direction. These quantities are dependent on the chemical composition of a ferromagnetic alloy and an investigation of the binary or ternary alloys for which they are zero leads to soft magnetic materials. For instance, Ni-Fe alloys (78·5 per cent Ni) have exceptionally high permeabilities due, in part, to a combination of low K and λ values. Zero values of K and λ occur simultaneously in a particular Fe-Si-Al alloy and as a result a soft magnetic alloy called " Sendust " is produced.

Turning to Si-Fe alloys, zero λ is obtained just above 6 per cent Si-Fe, and an appreciable lowering of K is also obtained below the pure iron value. Permeabilities some 100 times higher than the best oriented 3 per cent Si-Fe have been observed with a 6·4 per cent Si-Fe alloy. Measurements of total loss for 0·014in thick sheets of up to 8 per cent Si-Fe (Ruder) show a minimum near 6·5 per cent Si-Fe. Thus this material warrants further investigation, the problem being to find an additional alloying material which is magnetically neutral but will reduce the brittleness of 6·5 per cent Si-Fe to a usable value.

Belfast Boiler Contract

IN the Belfast High Court on 1st September Mr Justice Curran delivered his reserved judgment in the action brought against the Belfast Corporation in the matter of a contract placed with Babcock & Wilcox, Ltd., for boiler plant. Briefly the plaintiffs, Alderman C. McKee (a member of the Corporation) and others, asked the Court for an order of *mandamus* to restrain the Corporation from proceeding with the contract.

His Lordship said that Alderman McKee had established a breach of statutory duty by the Corporation in that it had not advertised publicly for tenders for the plant and, as he had previously demanded that that statutory duty should be performed and the Corporation had refused, a prima facie case for an order of mandamus had been made out.

Nevertheless the Corporation's standing orders enabled its Electricity Committee to use its discretion in such cases whether to invite tenders by public advertisement or otherwise. But the Committee was required to show that there were special considerations if it decided not to advertise.

The Court could therefore only require the Corporation to comply with its standing orders. If the Committee decided that there were special circumstances and recorded that decision in its minutes it could proceed to award the contract to the company whose tender had been accepted. If it could not do this it must invite tenders by public advertisement. He would be prepared to adjourn the matter to enable the Corporation to comply with the standing order, the status quo being maintained in the meantime. If the Corporation did not follow this course it would be necessary to grant an order requiring it to proceed in the manner prescribed by its Act and by its standing orders.

Mr. H. A. McVeigh, Q.C., the Corporation's counsel, was given time to study the judgment.

E.I.B.A. Hartlepools Branch

The third annual ball of the Hartlepools Branch of the Electrical Industries Benevolent Association is being held on 6th November next at the Grand Hotel, West Hartlepool. Tickets (£1 1s each) can be obtained from the hon. secretary, Electra House, Church Street, West Hartlepool.

Public Lighting

Details of Next Week's Conference of the Association of Public Lighting Engineers

NEXT week nearly a thousand delegates from local authorities and Electricity and Gas Boards throughout the British Isles will assemble in Liverpool for the annual conference of the Association of Public Lighting Engineers. Proceedings will open on Tuesday (15th September) at 10 a.m. at the Philharmonic Hall with the annual general meeting, followed at 10.30 a.m. by the induction of the president, Mr. C. C. Smith, city lighting engineer, Liverpool.

Following an address of welcome to the delegates the Lord Mayor of Liverpool, Alderman W. John Tristram will, at 11 a.m., officially open the exhibition of street lighting equipment at St. George's Hall. After inspecting the exhibits there he will also visit the outdoor display of steel and concrete lamp columns, bollards, tower wagons, etc., which has been arranged in St. John's Gardens, adjoining the exhibition hall.

In the afternoon at 2.30 p.m. the presidential address will be given at Picton Hall, followed by a paper by Mr. Geoffrey Fitton on "The Utilization Factor in Public Lighting." For the ladies attending the conference a visit has been arranged to Speke Hall with tea in the gardens. The Lord Mayor is to hold a civic reception at the Town Hall in the evening.

"Criteria in the Quality of Street Lighting" is the subject of a paper by Mr. J. B. de Boer, of Philips Lamps Technical Laboratory, Eindhoven, on Wednesday morning. After the annual luncheon at Lewis's Restaurant there is to be a river cruise in the *Royal Iris* with tea aboard, the boat being due back at Liverpool at 5.45 p.m. The evening is available for inspecting the exhibition and the Liverpool street lighting installations.

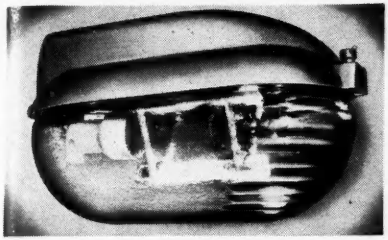
On Thursday morning Mr. M. H. Mounsdon (G.E.C.) speaks on "The Design and Manufacture of Street Lighting Lanterns," while in the afternoon M. André Boereboom, General Director of Electricity and Electro-mechanics, Ministry of Public Works, Belgium, and president of the Belgian National Commission of Public Lighting, will give a paper on "Public Lighting in Belgium." The ladies are invited to spend the afternoon inspecting the liner *Parthia*. The exhibition closes at 6 p.m., and in the evening there will be a reception by the president and Mrs. Smith at the Old State Restaurant.

The last paper will be presented on Friday morning by Mr. William H. Lythgoe, M.I.E.E.; its title is "Know Your Materials: Electronic Power Cables." It will be accompanied by demonstrations. The official proceedings conclude with votes of thanks at noon, but for the afternoon a cricket match has been organized at the Sefton Cricket Ground between "Makers" and "Users."

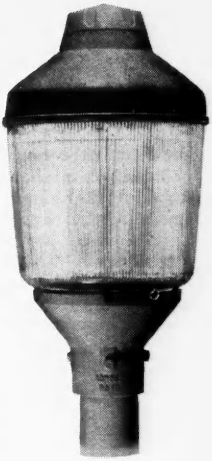
Arrangements have also been made for visiting places of interest during the conference, such as the Cathedral, the Mersey Tunnel, Ince Blundell Hall, Speke Airport, Knowsley Hall and Otterspool. Further details of these visits are obtainable at the official information bureau in the exhibition hall.

Preview of the Exhibition

With statistics showing that during the hours of darkness the roads are twice as dangerous to both pedestrian and motorist, mainly because of inadequate lighting, "Better Street Lighting—Increased Road Safety" is the theme of the Electrical Development Association's display at the exhibition. A number of enlarged photographs of modern electric street lighting schemes supported by charts, diagrams and other data are displayed. In particular, photographs illustrate the latest method of lighting streets in busy centres without columns for the lanterns, the latter being



Left: **Metrovick "Trafford II" lantern for mercury discharge lamps**



Right: **Holophane sodium post-top lantern giving a non-axial two-way light distribution**

mounted on the faces of buildings, thus saving space and reducing the hazards involved in the addition of the standards to the usual items of street "furniture" in most towns. Particulars of a new method of mounting lamps at road junctions are accompanied by a model of a typical installation.

The E.D.A. display should convince visitors that in modern electric street lighting improved light distribution, reduced glare and better colour-rendering combine to make seeing conditions more natural and comfortable to road users.

Two additions have been made recently to the "Metrovick" range of street lighting lanterns. The "SO Fifty" lantern for main road lighting with 85 or 140 W sodium lamps is now available with provision for fitting the auxiliary gear inside the lantern. This innovation meets a need in installations where there is no provision for housing auxiliary gear in the base of the columns. It will also enable authorities to use a column of smaller cross section causing less pavement obstruction and possibly enabling a less expensive type of pole to be used than formerly.

A top entry variation of the "Trafford II" lantern (illustrated) is now available for 250 W or 400 W mercury vapour lamps burning horizontally with a magnetic arc control device, or for mercury vapour lamps which are suitable for use without this device. Other "Metrovick" exhibits are the "SO Fifty-Two", an open type plastic lantern for sodium discharge lamps, available for either top or side entry mounting for both main and side roads and the "SS Fifty-One" for Group B roads, for either mercury or tungsten lamps.

Of special interest among Holophane equipment are two post-top units for Class B roads, a sodium cylindrical refractor lantern for Class A roads, a horizontal mercury discharge lantern and a single-piece bowl lantern for use with tungsten lamps. The two post-top lanterns both give two-way, non-axial light distribution and are designed for use with tungsten filament g.l.s. and sodium So/H discharge lamps respectively. The latter is illustrated. The filament post-top unit can also be used with mercury discharge lamps.

The sodium cylindrical refractor lantern incorporates an adjusting device which enables the correct angle of incidence of the main beams to the road surface to be maintained on gradients by rotation of the refractor cylinder, thus avoiding glare conditions. Refractors embodying the Holophane system of light control, in which the glass prism is used as a reflecting and refracting medium, meet nearly every street lighting requirement. Floodlights and "Lumilux" lighting pendants are also shown.

A new closed bowl assembly is shown for the Crompton "Concept 2" which has been designed to provide an improved composition of column and lantern by better application of materials. Concrete is used for the supporting arm and "Perspex" for the bowl assembly, the small amount of metalwork being almost entirely non-ferrous. Maintenance is reduced to re-lamping and occasional wiping of the bowl. The unit is shown incorporating the new Stanton pre-stressed columns.

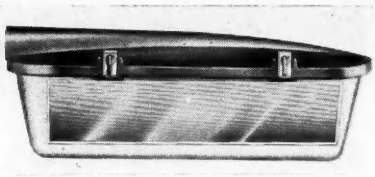
A new model of the Crompton "Corona II" lantern for 140 W sodium lamps accommodates the lamp auxiliary gear within its hood, a special advantage when erecting on existing poles and there is no room for the necessary auxiliary gear. There are new models of the "Lion" and

" Leo " main road lanterns and the " Sirius " and " Taurus " side road lanterns. The latest " Star I " and " Argus I " side road lanterns are fitted with enclosed springs for the retention of their prismatic glass refractors, while in the " Aries " main road sodium lantern the prismatic glass cylinder may be orientated to adjust the light beams in relation to the road surface, so avoiding glare on steep gradients.

Five Class A (single and twin bracket) and three Class B spun concrete lighting columns all approved by the Council of Industrial Design or the Royal Fine Art Commission are on view at the Stanton outdoor site. They are available either pre-stressed or with normal reinforcement to B.S. 1308 : 1946. On the Stanton stand in St. George's Hall pictures are shown of columns undergoing impact tests to show the relative resistance to shock loads by pre-stressed and normally reinforced concrete columns. The tests have proved that the pre-stressed columns withstand impact loads at least as well as the normally reinforced columns. A large aerial view of the company's concrete plant is accompanied by photographs of lighting column installations.

Several " Adastra " columns approved by the Council of Industrial Design are displayed by Poles, Ltd. Like all " Adastra " columns, they are constructed from tapering tubular steel sections which nest one inside another so that any length of column can, for transport purposes, be contained within the largest section (usually 6ft 7in in length). The columns are supplied in hexagonal or circular form (illustrated) and for any mounting height up to 60ft, the examples shown being for 15ft and 25ft mounting heights. They are all equipped with modern lanterns. A new narrow base column of double taper exhibited for the first time is a circular type for 15ft mounting height, while a floodlight tower is one of a series which will carry three heavy 1,500 W floodlights, at heights up to 60ft.

" Adastra " circular column, Class A, with double " Optim " arm



Falk, Stadelmann " Fulmar " lantern

The lighting fittings shown by the Revo Electric Co., Ltd., include units for use with tungsten, mercury, sodium and fluorescent lamps. One fitting is of aluminium alloy with a sheet steel vitreous enamel inner reflector, arranged to hinge for easy access to the interior; it is fitted with the patented " Kleen-Prism " refractor and is suitable for tungsten, mercury and fluorescent lamps. The " Critchley " lantern (illustrated) comprises a cast iron body and frame with vitreous enamel internal reflector and opalescent " Perspex " bowl. It takes two 60 W or 75 W lamps and is designed for wall mounting for Group B roads.

Other items include columns in cast iron, tubular steel and concrete to designs passed by the Royal Fine Art Commission and the Council of Industrial Design.

Falk, Stadelmann & Co., Ltd., have added two further lanterns to their " Fulmar " range for horizontally burning sodium discharge lamps (illustrated), one being arranged for side entry and the other for top entry. These are of the enclosed type, in contrast to others in the range which are of the open bottom type. In designing these lanterns efficiency and ease of maintenance have had first consideration. The light distri-

bution falls in the medium angle beam category of the British Standard Code of Practice. The lantern hoods are made of cast aluminium alloy stove enamelled outside and inside. The enclosing bowl is of clear " Perspex " having a slight pattern moulded on the inside to improve daylight appearance. Two refractor plates with machined prisms are hermetically sealed on the inside of the bowl which is smooth on its entire external and internal surfaces.

Siemens Electric Lamps & Supplies, Ltd., are showing a representative selection of equipment based upon the requirements of city and inter-city trunk roads.

The " City " lantern, primarily designed for vertical wall mounting in built-up areas, will be one of the main features. This lantern, originally installed in the City of London as part of the Coronation programme, is the first scientifically designed vertical burning lamp incorporating an optical system of prismatic refractors; it has three 80 W fluorescent tubes. The lantern can also be fixed to concrete or steel columns and has additional applications in the lighting of promenades and island sites.

The Siemens " Capital " lantern is suitable for mounting on existing trolley-bus poles. The vibration transmitted to the overhead-line poles by passing buses, is absorbed by a special " centre of gravity mounting " feature. The lantern is suitable for use with two or three 5ft fluorescent tubes, but 4ft tubes can be employed where necessary.

For trunk road lighting there is the " Bracknell " lantern employing a 140 W sodium lamp, and the " Cathay " pole-top mounting lantern provides a decorative lamp in keeping with contemporary town planning design. The company also has a display of attractive paint finishes for lanterns and a wide selection of electric discharge and filament lamps.

The Philips Electrical stand will be largely devoted to sodium lamps, of which Philips were the pioneers. Two interesting visual demonstrations of the efficiency of Philips sodium lamps will be given and two devices of great interest to public lighting engineers will be shown for the first time. New designs of the MBF/V lamps give improved colour rendering.

The exhibit of I.C.I., Ltd., is designed to show the use of " Perspex " acrylic sheet in street lighting lanterns both in the design of the lantern and as refractory components for controlling the light distribution. In addition the company will show a number of road signs made in " Perspex " and in " Darvic," rigid p.v.c. sheet.

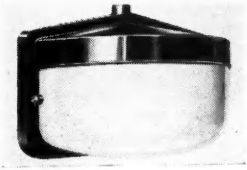
Time Switches

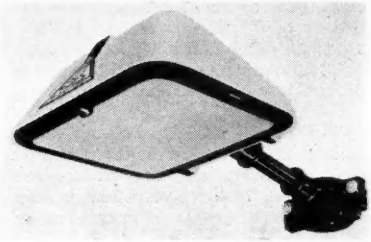
To meet the varying needs of all types of public lighting installations Venner, Ltd., has extended its range of time switches considerably. For the modern fluorescent lighting the small synchronous motor driven, solar dial double circuit switch type MSDC (illustrated) is of particular interest. It will switch on all the tubes in each lantern at sunset, and cut out a proportion at any set time, leaving the remainder illuminated until sunrise. This switch can also be supplied to effect a similar control for columns having main and subsidiary lighting: in this particular application allowance can be made for warming up sodium and mercury discharge lamps before the subsidiary lighting is switched off.

Although power cuts are now more infrequent than they were a few years ago, small time switches with spring reserve are still in great demand, particularly for scattered or rural areas. The type TJSSP time switch with nine hours' spring reserve, fits into any lamp post, has a long life and is easy to maintain. Venner time switches can also be supplied with various other types of clocks in single-, double- or triple-pole patterns for controlling loads from 5 to 300 A. The Venner " Zebra " flasher will be seen in operation.

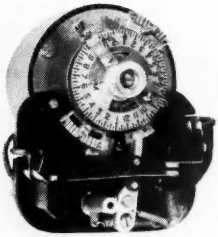
Sangamo Weston, Ltd., will be showing its type SS time switches, including the type SSC (illustrated) fitted with a solar dial for operating at the times of sunrise and sunset. In addition, a selection of Weston electrical measuring instruments will be on view, covering all requirements from laboratory standards to miniature panel instruments and photo-electric exposure meters.

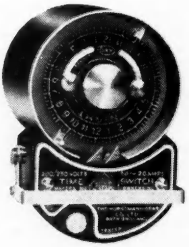
The Horstmann Gear Co.'s time switches comprise hand wound (15, 21 and 40 day run), electrically wound and synchronous models with or without spring reserve. The type " Y " plug-in unit (illustrated), which is electrically wound and incorporates a spring reserve, is claimed to be the smallest switch of its type on the market and can be fitted readily into the modern " streamlined " lamp column where space

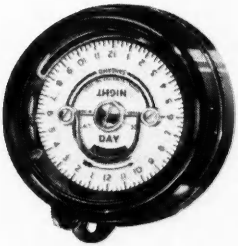




Revo "Critchley" lantern and (right) Gowshall "Signalite" external lighting unit for illuminating all traffic signs







Left: **Venner type MSDC switch.** *Centre:* **Horstmann type "Y" time switch.** *Right:* **Sangamo Weston type SSC time switch**

is necessarily limited. A new flasher unit for illuminated pedestrian crossing beacons is also shown.

Illuminated guardposts and "Signalite" lighting units (illustrated) for externally illuminating all traffic signs are accompanied in the Gowshall display by centre-island floodlight fittings and flashing beacons. All the items conform to M.O.T. requirements, and include the guardpost "50" which has no components, not even hinges, protruding and is designed for easy maintenance.

Stewarts & Lloyds, Ltd., are exhibiting a selection of standard tubular steel street lighting columns including eight suitable for Group A roads (25ft mounting height), and four suitable for Group B roads 13ft and 15ft mounting heights). All these columns meet the recommendations of the Ministry of Transport Departmental Committee on Street Lighting. They are fitted with up-to-date varieties of pendant, side entry and top mounting lanterns, and lanterns with fluorescent tubular lamps—all lent by the manufacturers for this display.

Tower wagons available from the Ford Motor Co., Ltd., in three or four stage construction incorporate a revolving platform turning through 360 deg and having eight locking positions. Elevation is carried out hydraulically and a special device in the base of the ram controls the speed of lowering. R. A. Lister & Co., Ltd., will show their "Eclipse" portable telescopic tower ladder.

Exhibits by W. T. Henley's Telegraph Works Co., Ltd., include rubber insulated and p.v.c. cables and flexible cords; metallic flexible armoured cables and cords; low voltage p.i.l.c. cables; aluminium sheathed and super-tension cables; tapes and compounds, including plastic compound; and a comprehensive range of distribution equipment.

Emergency Lighting in Hospitals

THE paper on "Emergency Lighting Systems and Lead Acid Batteries Appertaining to Hospitals" that was recently delivered by Mr. R. A. Harvey, B.Sc.(Eng.), A.M.I.E.E., of Chloride Batteries, Ltd., at the summer school at Cardiff of the Institution of Hospital Engineers provided one of the rarely occurring opportunities of discussing the latest developments of the subject, or available apparatus and circuiting for the purpose. The need for proper maintenance cannot be overstressed.

FUEL ECONOMY

Team's Conclusions from Visit to United States

A REPORT entitled "Fuel Conservation" published last Monday at 5s by the British Productivity Council, 21, Tothill Street, London, S.W.1, presents the findings of twelve fuel utilization specialists, drawn from several large industries, after a visit last year to the United States. The team points out that some 80 per cent of the heat of rapidly dwindling coal reserves (especially of carbonizing types) in Great Britain is lost largely because of ineffective utilization; it considers that 30 per cent of the fuel consumed by British manufacturing industries could be saved.

It is claimed that the best plants are as efficient as any in the world, but that great waste occurs in the "rank and file" factories which use the bulk of the coal; an example is the existence of 120,000 Lancashire boilers from many of which 10 tons an hour of excess air is discharged to the stacks, causing an aggregate yearly loss of 10 million tons of coal. Much could be achieved if capital could be made available to replace all obsolete fuel-using equipment.

Instances are given of unnecessary loss of heat in various trades and of the need for education and training of boiler house operatives to a high standard which would lead to the holding of certificates of competence. It is considered unlikely that industry will improve fuel utilization methods without active assistance, persuasion or legislative coercion.*

For every 1 per cent saved in the production of steam (the most generally misused commodity), 5 per cent or more might be saved in utilization. The works engineer should have equal status with the production manager in all matters relating to processes, since the separation of engineering from processing departments in the United Kingdom, as distinct from the United States, is responsible for considerable waste. A wider distribution of high pressure hot water rather than steam is advocated.

Probably no single factor is more important than better heat insulation, which could save 5 million tons of coal a year; this should be made compulsory for new buildings. American practice is considerably ahead of British in this respect. At least 25 per cent of the heat escapes through the roof and ceiling of an uninsulated house; this loss could be reduced by 70 per cent.

Electricity Generation

The team considers it unlikely that the average overall thermal efficiency of public electricity generation in the United Kingdom, using the condensing cycle, will ever appreciably exceed 30 per cent. It holds that while such power stations would probably continue to produce the bulk of energy supplied for the next thirty years when atomic energy might become economic, thermal efficiencies of 70 per cent could be achieved through the extensive construction of dual-purpose stations containing back-pressure or pass-out turbo-alternators. These could supply exhaust or bled steam to nearby industrial, commercial or domestic premises and would be operated either by the British Electricity Authority or by local industrial groups rather than by individual factories. The B.E.A. is understood to be investigating the possibility of establishing a dual-purpose station at Warrington to supply 500,000 lb/hr of steam at 50 lb/sq in and 25 MW to 43 potential customers within a mile radius. A similar station is suggested for Kidderminster to provide 400,000 lb of steam and 12 MW.

Industrial generating plant in the United States reached 14,000 MW in 1950 (32 per cent over 1939) and produced one-sixth of the total national output of electricity. Comparative figures for Great Britain are not available, but assuming the same proportion to hold here, the corresponding

* Since this Report was written a 20-year loan scheme, interest free for two years, and an industrial fuel efficiency organization have been instituted.

output would be 9,000 million kWh; this, the report states, could be generated by back-pressure plant at not less than 60 per cent thermal efficiency. Examples are given of important private dual-purpose installations and other developments, including fuel saving equipment, in the United States.

For space heating much more attention is given to the degree-day method of measuring in the United States where a considerable use of instruments for allocating costs of steam and power between factory departments has been found conducive to greater efficiency. The team deprecates the use of electricity for space heating, but the relationship of this observation with fuel conservation is not made clear.

In a section comparing the fuel resources of the two countries, it is shown that in the United States, whose coal deposits form two-fifths of the world's known total, over half of the output is obtained by open-drift and open-cast mining. More than 400 million tons of bituminous coal and 45 million tons of anthracite are mined yearly, but during the war emergency the total reached 680 million tons. Although oil production is over half the world total, to meet expanding demands oil has to be imported. Industry uses about 60 per cent of the natural gas distributed by utility companies and 30 per cent of homes are so heated. Only about one-quarter of the total water power resources has so far been harnessed, but this represents nearly a third of the electrical energy produced. As regards research the main emphasis in America is much more on the applied type than in the United Kingdom where fundamental research is more predominant.

The spearhead of the attack on misuse of fuel is regarded by the team as the co-ordination of the coal, electricity and gas services under a non-political board.

Electrical Research

Survey of New E.R.A. Reports

AMONG the latest reports to be issued by the British Electrical and Allied Industries Research Association is Ref. G/T262 "Gas-Blast Circuit Breakers. Effect of Arcing on the Mass-Flow of Air through the Nozzle and on Nozzle Pressure" (Second Progress Report), by A. A. Hudson, B.Sc., Wh.Sc. (6s 3d). It describes a continuation of the investigation into the aerodynamic conditions during arcing in the nozzle of a gas-blast circuit-breaker.

The mass flow of air from the arc chamber to the nozzle has been determined by the rate-of-change method used in Refs. G/T234 and G/T255 for a second value of arc chamber pressure (115 lb/sq in gauge). The ranges covered were:—Current 2,000 to 8,000 A (r.m.s.); nozzle diameter 1·0, 1·5, 2·0 and 2·5 cm; lower gap zero 1·0 and 2·0 cm. It was found that the mass flow from the chamber during arcing was again a function of $I/d^{1.5}$ as in the case when an arc chamber pressure of 80 lb/sq in gauge was used.

A comparison has been made for the three values of lower gap used, between the mass-flow at the two values of arc chamber pressure (viz. 80 and 115 lb/sq in gauge). The effect of the arc on the pressure at the two points at the upstream end of the nozzle was determined for the ranges of current, nozzle diameter and lower gap covered in these tests, and it was found that the increase in pressure above the value with no arc present was greater at the upstream end than at the downstream end of the nozzle.

The liquid silicones previously investigated in Ref. L/T201 have been studied at higher frequencies and temperatures and a description of the work is given in Ref. L/T247, "The Dielectric Properties of Silicone Liquids, II," by E. Rushton (N.P.L.) (4s 9d). The results at the higher frequencies confirm the findings of the previous report that the relaxation time appears to be practically independent of viscosity or chain length. The power factor of the more viscous liquids from 20 centistokes upwards, reaches 0·02 at 9,000 Mc/s and between 0·03 and 0·04 at

24,000 Mc/s, and that of low viscosity (0·65 centistokes) liquid reaches 0·005. The observed variations of permittivity and power factor with frequency can be represented roughly by the Debye equations for dipole absorption and dispersion. The permittivity decreases with increasing temperature, the variation of permittivity with temperature being related to the changes in density. The power factor is still relatively small at up to 150 deg C and 1 Mc/s.

Radio Interference

The performance and characteristics of equipment for measuring radio interference in the range 0·15 to 30 Mc/s are prescribed in the latest revision of B.S.727. This standard is intended primarily for equipment to be used for measurements in relation to interference with the reception of broadcasting in this country. Except that the signal-to-noise ratios for satisfactory reception are not the same and that the bandwidth of military equipment is generally narrower than that used for broadcast programmes, the problem of interference with military communications differs little from that envisaged in the above standard.

The equipment described in Ref.M/T116, "Measurements of Radio Interference in the Frequency Range 0·15 to 30 Mc/s. A Portable Measuring Set," by S. F. Pearce and D. C. G. Smith (10s 9d), has been developed under contract to the Admiralty and has been designed to conform, in essential features, with the standard. Despite the severe restrictions on bulk it has been possible to produce a receiver conforming to B.S.727 in all features except the requirements for image frequency rejection and intermediate frequency rejection.

B.S.800 "Limits of Radio Interference" requires that all r.f. noise voltages developed at the terminals of an electrical appliance shall be measured across a substantially resistive load of 150 Ω in the manner prescribed in B.S.727. Ref. M/T117, "Measurement of Radio Interference in the Frequency Range 0·15 to 30 Mc/s. A Mains Isolating Unit," by J. Miedzinski and S. F. Pearce (12s 10d), describes the design and construction of a mains isolating unit which meets the requirements of the latter standard. The unit is suitable for making measurements on appliances for use on mains voltages up to 250 V d.c. or single-phase a.c. The continuous current rating is 5 A; provided loading is intermittent the rating may be increased to 10 A. Full design details are given in figures included in the report.

Discharges in Dielectrics

In Ref. L/T271, "Discharges in Dielectrics at High Voltages and in the Presence of Harmonics," by J. H. Mason (12s 4d), the variation of the discharge sequence in insulation with applied alternating voltage has been investigated up to four times the inception voltage, with and without a superposed 10th harmonic, and with unidirectional voltage pulses. At voltages exceeding twice the inception value the discharge sequence in voids enclosed in polythene differs from that predicted by Austen and Whitehead. In particular, discharges in the quadrants of falling voltage begin much later than expected.

The discharge sequence can be interpreted if the interdependence of adjacent discharge sites is considered and if the first discharge occurs at a lower stress in the void than any subsequent discharge. If the void is adjacent to a conductor the effect of residual surface charges is reduced and the discharge sequence is similar to that predicted by Austen and Whitehead. The superposition of a harmonic increases the number of discharges appreciably only if the harmonic voltage exceeds the inception voltage. When unidirectional pulses are applied, continuous discharges occur only if the pulse voltage exceeds about twice the inception voltage.

Definitions of terms used in power system studies have been drawn up for submission to the British Standards Institution with a view to their incorporation in a B.S. glossary and they are recorded in Ref. V/S1, "Recommended Definitions of Terms Used in Power System Studies" (15s 4d).

Copies of the reports described above are available post free, at the prices indicated in parentheses, on application to the E.R.A. at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Educational

The 1953-54 session of the Department of Electrical Engineering at the College of Technology, Birmingham, commences on 21st September. The prospectus can be obtained from the College, 53, Broad Street, Birmingham, 1.

British Association

The Value of Pure Science

THIS year's meeting of the British Association for the Advancement of Science was opened at Liverpool on Wednesday, 2nd September. A graduation ceremony at the Philharmonic Hall, Hope Street, preceded the inaugural meeting at which the presidential address was delivered by Sir Edward Appleton.

The President spoke on " Science for its own Sake " and emphasized that science had interest as well as utility and was illuminating as well as fruitful; this was at times in danger of being overlooked. He commented on the fruitlessness of pondering over a scientific problem too long; often the best way of solving a scientific difficulty was to leave it alone.

Sir Edward Appleton

Speaking as a professional scientist who had only recently turned amateur he acknowledged the great debt that science owed to members of the latter category. Sir Edward spoke in general terms of the scientist's approach to nature and of the kinds of mental quality and awareness that science required in its followers. He then passed on to the comparatively new subject of radio-meteorology and described some of the discoveries which had been made. The story, he said, was far from complete but already achievements had been recorded in the three centres of Cambridge, Sydney and Manchester, partly in competition and partly in collaboration, worthy to be ranked with the greatest of feats in the art of experiment.

The President endeavoured to show how science pursued for its own sake could enlarge man's horizons and invest the world with deeper significance. As an exercise it could be claimed to be one of the most complex and far ranging of mental experiences, but it should not be forgotten that there were other values and other experiences. At the opposite pole from scientific endeavour there were the ways of thought that did not change, whose concern was with what was not new, with the things that would not be superseded; and to-day we were in need of these enduring, sustaining values of the spirit more than ever.

Next Two Thousand Years

In his presidential address to Section G —Engineering, Lord Dudley Gordon suggested how the science and practice of engineering might develop during the next two thousand years. Up to recent years energy for power had been provided mainly from heat created by the combustion of materials found in the earth. In the early days of the industrial era little care was taken to preserve such resources because they appeared to be virtually inexhaustible. It had now been realized that at the present rate of progress there was a limit to these supplies, but so much thought was being given to the possibility of development of nuclear energy that less anxiety existed about the question of supplies.

Lord Dudley Gordon then referred at some length to the generation of electricity from water power, wind, tides and solar energy. He next discussed the two main problems which would have to be solved in the future: the provision of sufficient power to meet world demands, and the supply of materials which would make the application of that power useful to mankind.

He indicated some of the problems which would have to be solved during the next two thousand years and said it seemed reasonable to assume that we had reached a stage in the development of scientific knowledge which could form a basis for future advance with a diminishing reliance on the principle of trial and error. It would seem, therefore, that the present generation had not merely a great opportunity but a great responsibility to start now to develop methods which would make it possible for the progress of man to

continue when the resources at present available had become exhausted.

Computing Machines

A paper on the use of electronic digital computing machines in engineering was presented to Section G (Engineering) on 3rd September, by Mr. R. K. Livesley of Manchester University. A digital computer, said Mr. Livesley, consisted essentially of a high speed "store" with a capacity generally of between 100 and 1,000 numbers, each with about 10 decimal digits, and an arithmetic unit, which performed operations in sequence on those numbers at a rate of about 1,000/sec under the control of a "routine," or list of coded instructions, each instruction corresponding to one operation.

To make a calculation the relevant routine and numerical data must first be fed into the machine, usually by punched cards or teleprinter tape. Results were either recorded in the same way or typed out for immediate visual inspection.

A digital computer would carry out any calculation as performed on a desk calculating machine if first supplied with a detailed account of the operations required. The collection of "routines" for a computation was known as a "programme." The first few years of a computing organization was largely spent in building up a library of basic routines, such as the generation of elementary functions, the solution of sets of linear algebraic and differential equations and the inversion of matrices, which had only to be connected, as required, in suitable order.

A non-repetitive calculation which would take more than four weeks to complete with a desk machine was probably worth programming, but smaller problems were best done by hand. Most engineering problems, however, were repetitive, some calculations being repeated for various sets of initial data, so that with a digital computer a single programme, once developed, might be used to solve an indefinite number of separate problems. The overall machine speed of the Manchester computer was about 150 times that of hand computation.

Electronic Telephone Switching

In "Electronics in the Switching of Telephone Calls," a paper he presented on 4th September, Mr. L. J. Murray discussed the use of electronics in telephone switching and gave a description of electronic methods of setting up calls on crossbar switching mechanisms, with particular reference to selecting and setting up the speech path between any given pair of subscribers. An application of electronics to the talking connection was the direct replacement of the electro-mechanical switch wipers and bank contacts by triggered devices, such as thermionic tubes, cold-cathode tubes, transistors, rectifiers, etc., in which the engagement of a wiper with a bank contact, or the closing of a relay type contact, was represented by the rapid change of the electronic device from a non-conducting to a conducting state.

With electronic devices there was a much greater liability to attenuation, distortion and noise, but these did not necessarily rule out their use. Cold-cathode tubes, for example, could be used as contacts in the speech path with suitable design of circuits to compensate for any attenuation or distortion introduced by the tube itself, and inherent noise level could probably be reduced to negligible proportions by tube design. While it was not yet clear whether present electro-mechanical switching contacts could be advantageously replaced by electronic devices, no doubt the present electro-magnetic relay control of switching could.

Comparison of Cost

The question as to whether switching should become wholly electronic or semi-electronic was raised in the discussion and Mr. S. Welch (Telephone Switching Division, Post Office Research Station) said it was not fair to take the costs of the switching equipment alone when considering electronics; the costs of the line plant and network as well as the exchange switching should be integrated. By wholly electronic switching it was possible to degrade the line plant compared with normal standards and thus cheapen the system. Time would probably show that electronic equipment was at least as reliable as the electro-mechanical equipment, and possibly more reliable because of the absence of contact trouble.

The transistor would make wholly electronic exchanges more possible than ever, and a further point favouring wholly electronic switching, in the case of frequency division multiplex, was that the exchange

could be dispersed. Multiplex selectors could be placed at out-station points near a concentration of subscribers, and those small exchanges could be interconnected at a central switching point, which would effect economy.

In reply Mr. Murray agreed that a fully electronic system, especially of the multiplex type, might have a considerable effect on the transmission characteristics required for the lines, but he thought the transmission network was by far the more important part of the cost of the telephone system; that factor made for the retention of the present type of transmission layout.

Colour and Television

In his paper "The Application of Colour to Television Broadcasting," Mr. F. C. McLean, C.B.E. (deputy chief engineer, British Broadcasting Corporation) outlined some of the problems involved in this field and the factors affecting their solution. A compatible system was one in which an existing monochrome receiver could without modification reproduce a black and white picture from the same transmission as would produce a colour picture on a suitable receiver. A system was non-compatible if the existing receiver could not reproduce a black and white picture from such a transmission. Broadly speaking, that meant that the brightness components of the picture, at least, must be transmitted in the same bandwidth, to the same standards and on the same channel as the monochrome picture. All those requirements reflected directly on the generation of the signal and necessarily implied the addition of complication at the transmitter and camera end in order to achieve as much simplification as possible at the receiver end.

All observers would agree on a true white light, which consisted of equal energy on all the colours in the spectrum. The amounts of the three selected colours required to give the effect of white light would vary to a certain extent with the eye of the observer, and also with the wavelengths selected for the primary colours. But the basic problem was either to transmit separate pictures in each of the three colours, or such information as would enable the three colours to be derived.

The general colour requirements for a system for the United Kingdom would no doubt be decided by the Government on the advice of the Television Advisory Committee, which had already recommended that any future colour system should be compatible in the sense that the colour transmissions should be receivable in monochrome on receivers not designed for colour.

Nuclear Power

Discussing the outlook for economic nuclear power on 4th September, Professor B. L. Goodlet said that present projects aimed to use the heat released by nuclear fission to work a heat engine, starting as an offshoot of the atomic weapon industry which produced fissile material for bombs. This fissile material might be either Uranium 235, separated from natural uranium in a diffusion plant, or Plutonium 239 made from natural uranium in a nuclear reactor or pile. Nuclear reactors released heat as a by-product and the most obvious method was to build production piles using natural uranium in which this heat was released at a temperature high enough to use in a heat engine. The cost of operation could then be spread over the two products, plutonium and electric power.

Unfortunately there were design conflicts in such dual purpose plants; moreover natural uranium reactors could consume only part of the U235 which itself constitutes only 1 part in 140 of natural uranium, whereas in principle all the 139 parts of U238 could be converted into plutonium and would then be available as fuel.

Breeder reactors produced more fissile material than they consumed and so opened up the prospect of complete utilization of the U238 which constitutes the bulk of natural uranium. The repeated chemical processing of the fuel, an essential feature of the breeding cycle, was, however, likely to inflate operating costs. The general picture is thus that the natural uranium reactor with relatively low operating costs was wasteful of fuel, while the breeder reactor achieved efficient fuel utilization at great expense.

The capital cost of any kind of nuclear power plant feasible at the present time was much greater than that of a coal fired plant of conventional design. In addition radio activity might have to be kept under rigorous control until it had decayed so far as no longer to constitute a hazard.

Solar energy provided the subject for a paper on 4th September by Dr. H.

Heywood, who suggested that nuclear fission and solar radiation were complementary. The former for large power stations serving industrial communities and the latter for small power units in undeveloped areas.

Collection of solar radiation involved an air mass factor (depth of atmosphere through which the radiation passes), the altitude factor (position of the collecting surface) and the cloud factor. The last factor constituted the greatest handicap, especially in temperate latitudes. Heat collecting surfaces could be classed as flat-plate absorbers, generally fixed in position, or mirror concentrating systems which must be movable to follow the apparent motion of the sun. Flat-plate absorbers were essentially water-cooled metal surfaces covered on the front by sheets of glass and protected at the back by heat insulation. Mirror systems concentrated the energy received upon a relatively small absorbing surface, thereby reducing the heat loss and giving higher temperatures.

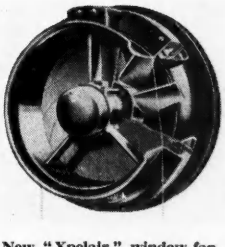
Solar energy could supply low grade heat for domestic purposes on days of high radiation, but the poor load factor would prevent extensive application in this country. Small electrical generators or pumping units would be a great benefit in undeveloped areas. Thermodynamic engine efficiency increased with the upper temperature limit of the working fluid and would therefore be greater with mirror systems. However, the expense of such systems might be greater than that of less efficient fixed systems. Power units of 5 to 10 kW could probably be successfully operated but such units would be expensive and at first assistance from national sources would be required for their construction.

Other fields of application, such as refrigeration, air conditioning and water distillation, constituted the ideal load for tropical areas. The problems to be solved were basically those of design and construction, rather than the introduction of new principles.

Draught-proof Window Fan

A DISADVANTAGE hitherto of window fans has been draught when the fan is switched off. Some attempts have been made to prevent this by incorporating a louvre shutter or damper, but without much success. The General Electric Co., Ltd., has now introduced a new "Xpelair" fan incorporating an iris shutter, on the principle of a camera aperture, which excludes draught completely.

Linked with an inbuilt fan switch, the shutter is operated by two nylon cords. A pull on one cord opens the shutter and starts the fan. A pull on the other closes the aperture and switches the fan off. When open the shutter disappears into a narrow recess in the casing, allowing unrestricted air extraction. Made of plastic, it is non-corroding. When closed it seals the fan aperture completely, preventing any draught coming in. The fan is designed so that the fan portion can be quickly removed for cleaning without disturbing the part fixed to the window.



New "Xpelair" window fan, showing the iris shutter

There are two sizes having extraction capacities of 15,000 and 30,000 cu ft/hr respectively. If required for windows with close-fitting shutters both sizes can be supplied without the outlet baffles. The units then project only 1¼in from the window surface. For internal positions, where back-draught is not a problem, they can be supplied without the shutter and switch. The rate of air extraction can be varied by means of a remote control speed regulator which gives four different fan speeds and an off position. Enclosed in a brown plastic case, it has a warning light in the control knob to show when the fan is switched on. The casing and outlet baffles are brown plastic mouldings. The fan motor is totally enclosed and fitted with silent running SASO sleeve bearings. Although designed chiefly for fitting into window glass or partitions up to 1in thick, the "Xpelair" fan is equally suitable for installation in outside walls.

Trades Union Congress

Industrial Productivity and Living Standards

AT the Trades Union Congress which was held at Douglas, Isle of Man, this week Mr. T. O'Brien, M.P., in his presidential address, recalled that the first Congress was held eighty-five years ago in Manchester. Then there assembled 34 representatives of 118,000 trade unionists organized in 34 trade societies. At this year's gathering there were nearly a thousand, representing 183 unions with an aggregate membership of more than eight million.

Reminding Congress that throughout its history the trade union movement had consistently maintained its independence, Mr. O'Brien said it had asserted its right to make its own decisions through its own machinery. It had never subordinated itself to political parties, or taken its instructions from governments.

If trade unions were weaker, or less independent, democracy would be weaker and more vulnerable Democracies could make mistakes, and admit them and correct them. Totalitarian societies could never admit errors because all such régimes exist by creating and maintaining an illusion of infallibility.

Turning to the present economic situation, Mr. O'Brien said the fall in raw material prices during the past twelve months had been of such a character that our balance of payments problem had been greatly eased. These were the imports on which our great industries depended. At the same time prices of exports had remained relatively steady.

Production and Exports

It would be foolish, however, to think that a favourable trend of this character must necessarily continue. This situation could change as rapidly as it changed in 1950. The only effective way in which we could insure against this was by raising production and increasing exports. "Our trade union movement," said Mr. O'Brien, "has to make its full contribution to this end: no financial juggling, no clever attempts to produce a popular Budget can ever escape the obligation to raise production and increase exports. This is the basic fact which persists whether the Government is Labour or Conservative."

Overseas Competition

In a reference to growing international competition, Mr. O'Brien said that the competitive struggle for overseas markets was growing keener. Our competitors now included not only the United States, but Japan, Germany and other European countries in the field of certain manufactures.

From the narrow point of view of the nation's self-interest our exports must be increased. That could only be done if prices were right and if we delivered goods of quality on time. But the trade union movement had never been actuated solely by self-interest. They had always taken their international responsibilities seriously, and they had a particular responsibility in relation to the Colonies and the Commonwealth.

There were great and adventurous developments taking place which were not recognized as fully as they should be, perhaps because of the prosaic sound of their titles. They talked of the Colombo Plan, the Chief Joseph Dam and the Volta River Project, and they knew by name many other gigantic engineering projects. If they translated their names and titles into terms of human endeavour and human sacrifice they would know better what is afoot.

"Let our imagination take in the human significance of these stupendous schemes which will provide power over vast areas and lessen the load of labour and bring the benefits of modern civilization to peoples who feel that their own exploitation should end and be substituted by the exploitation of nature. That is what increased production means."

It was the aim of trade unions to raise the living standards of their members. Increased productivity was the means to

that end. The idea of deliberately refusing to increase productivity was simply nonsensical. It was almost weakminded to suggest that increased productivity simply meant more profit for the bosses and no profit for anyone else.

Dealing with the cost of living Mr. O'Brien said that among the most essential commodities in every-day use particularly prices had continued to increase, largely because of the cutting down of subsidies which allowed prices to rise naturally to their own high level.

In such circumstances trade unions could have no choice but to take the necessary steps to safeguard their members' interests. But in that field too unions were confronted with a dilemma. If they took steps to increase wages it was a virtual certainty that the increased cost would be passed on to the consumer by way of price increases; and most of the consumers were wage earners. So every trade union to-day accepted the principle that protection of its members did not lie wholly in securing an increase of money wages. It also necessitated a close and careful scrutiny of economic policy and trends in order to safeguard their members' employment. A reasonable rate for the job was only a part of the test. It was equally important that there should not only be a good rate for the job, flexibly adjusted to price movements, but that there should be a job available to which the rate applied.

The programme of Congress is a formidable one, but to some correspondents it seems a little unbalanced. Crowded in Wednesday and Thursday were big debates on national service, productivity, social ownership and nationalization, electricity supply, iron and steel denationalization, East-West trade, peace, rearmament, wages and wage restraint.

Electrical Contracting Dispute

FOLLOWING the breakdown of negotiations on the Electrical Trades Union's claim for an increase in wages for its members in the electrical contracting industry, reported in our last issue, there was a resumption of the "guerrilla" strikes. In several cases the firms of members of the National Federated Electrical Association's Executive Committee were affected and a statement was issued by Mr. L. C. Penwill, the Director, condemning these tactics. He said that in furtherance of the Government-sponsored policy of collective bargaining on a voluntary basis, it was necessary to establish a joint body representative of both sides of industry to negotiate wages and working conditions. The employers' representatives were a body of public spirited people who voluntarily gave of their time and effort in the interest of their industry and, he claimed, in the interest of the community as a whole. Was it the object of the E.T.U. by its attacks on these people to frighten them into submission or was it the first stage of an attempt to secure the abolition of the principle of collective bargaining by making it impossible for the joint industrial machinery to function?

Commenting on Mr. Penwill's statement, Mr. W. Stevens, secretary of the E.T.U., said that the only reason that the representatives of the employers' side of the National Joint Industrial Council were singled out for action was that at the recent meeting of the N.J.I.C. they "showed scant regard for the dilemma their fellow-employers were in, who were feeling the full brunt of the strike."

Later it was announced that an agreement had been concluded with Earls Court, Ltd., for a wage increase of 3d an hour and that as a result a large staff of electricians would be prepared to work all night to complete work on the stands at the Radio Show. The company agreed to engage all electricians working at Earls Court but employed by outside contractors at the new rate. Previously, although not a party to the agreements with the N.F.E.A., Earls Court, Ltd., had followed the rates agreed upon between the Association and the Union.

Asked whether the Union would now try to obtain separate agreements on these lines with other employers, Mr. Stevens said that the Union had no desire that the employers' association should disintegrate. The Union had been offered advances by two federated employers and had not accepted them.

On Monday this week Mr. Stevens, while attending the Trades Union Congress at Douglas, I.O.M., said that at least 4,500 electricians were then on strike and that unless a settlement was reached the number might rise to 20,000. The Scottish Electrical Contractors' Association might also be involved.

The Ministry of Labour invited both sides in the dispute to attend separate meetings with its conciliation officers on Tuesday evening last.

PERSONAL and SOCIAL

News of Men and Women of the Industry

GOVERNMENT changes announced from Downing Street last week included the appointment of **Mr. D. Heathcote Amory** as Minister of State to assist the President of the Board of Trade in matters relating to exports and problems of overseas trade generally. The Secretary for Overseas Trade (**Brig. H. R. Mackeson**) has resigned that post which will not be continued. **Lord Leathers,** Secretary of State for Co-ordination of Transport, Fuel and Power, has resigned and no new appointment is to be made. **Sir Arthur Salter** has also resigned the position of Minister of Materials and **Lord Woolton** (Chancellor of the Duchy of Lancaster) will take over the remaining functions of that Ministry which have been diminished by the removal of many materials from control.

Mr. J. A. Fraser has been appointed general sales manager of the group of companies controlled by the Southern Areas Electric Corporation, Ltd. Mr. Fraser was educated at Stirling Academy and joined the Electric Heating and Cooking Department of the Carron Company in 1920, becoming commercial manager of the company in 1930. He was appointed sales manager of the Domestic Appliances Division of the English Electric Co., Ltd., in 1936, a position which he held until April this year. Mr. Fraser was formerly vice-chairman of the B.E.A.M.A. Cooker Group.

Mr. J. A. Fraser

Mr. P. H. Nye, manager of the Business Development Department of the General Electric Co., Ltd., is retiring on 30th September after completing fifty-four years' service. Mr. Nye started his career in the company's Estimating Department and subsequently spent two years at the G.E.C. Union Street Works, at Southwark. After this, he was appointed assistant manager of the then Arc Lamp and Carbon Department at Queen Victoria Street, where he remained for five years. Later (in 1906) he was sent to manage the Electrical Department of the G.E.C. agents in Hong Kong. He returned to England in 1910 and a year later was appointed managing director of the General Electric Co. of China, Ltd., formed in the same year. On his return to China in 1911, Mr. Nye took with him a number of G.E.C. staff and opened the head office of the newly formed company in Shanghai, with branches in Hong Kong, Tientsin, Hankow and Manchuria. In 1930 he retired from the General Electric Co. of China, Ltd., and was appointed manager of the Business Development Department at Magnet House, Kingsway.

Mr. S. W. Richards, manager of the Mines Department of the General Electric Co., Ltd., since its formation, retired on 31st August. Mr. Richards joined the G.E.C. in 1931 on the company's acquisition of the Sterling Telephone Co., Ltd., of which he was then mining sales manager, and he was given the task of forming a department to deal with the special electrical problems of the mining industry. He commenced his career with the British Westinghouse Co., at Trafford Park, Manchester, and gained experience in various collieries in South Wales, first as electrical and mechanical engineer, then as underground official, surveyor and manager. He also studied the science of mining in Germany and Silesia. Mr. Richards holds the silver and bronze medals of the National Association of Colliery Managers and was national president of the Association of Mining Electrical and Mechanical Engineers in 1949.

Mr. R. F. Galloway, who commenced with W. T. Henley's Telegraph Works Co., Ltd., in 1926 as manager of their branch at Brisbane, Australia, retired on 31st July last having held that position throughout his service with the company. He is succeeded by **Mr. E. M. Dawes,** who commenced his service with the company in 1948, and served at their works and head office until 1949, when he went to Australia, taking up an appointment as sales engineer at Henley's Melbourne branch, being transferred to the Brisbane branch in 1952.

Wilkins & Mitchell, Ltd., announce the appointments of the following as divisional

sales managers in their "Servis" organization :—Mr. F. McL. Bruck (N.E. Division, Bradford); Mr. J. Sheppard (N.W. Division, Manchester); Mr. J. E. Gutteridge (S.W. Division, Wolverhampton); Mr. J. Cooper (S.E. Division, Nottingham); and Mr. W. B. Middleton (Irish Division); Mr. L. R. Hall becomes commercial manager, London Sales Divisions, with Mr. A. Knowlden as divisional sales manager, London (South) Division.

Mr. Thomas A. Holme, M.B.E., who was closely associated with the development and production of fabricated (welded steel) structures in the electrical industry for the last twenty-five years, retired from the British Thomson-Houston Co., Ltd., on 31st August. Mr. Holme served an apprenticeship with Vickers, Sons & Maxim, Barrow-in-Furness. He joined the B.T.H. Co. as a fitter in January, 1919, and in May, 1927, went to South Africa to carry out work on a B.T.H. contract. Returning to England in November, 1928, he was engaged as assistant foreman on fabricated stator work in the company's generator factory. In November, 1937, Mr. Holme became chief assistant to Mr. H. W. Hawkins, the first head of the new fabrication factory, and in April, 1940, on the death of Mr. Hawkins, he succeeded to that position, which he held until June, 1949, when, for health reasons, he asked to be relieved of this responsibility but agreed to remain with the company as a consultant on matters concerning the fabrication factory and its work. Mr. Holme was awarded the M.B.E. in 1949 and celebrated his seventy-second birthday on 27th August last.

Mr. T. A. Holme

On his retirement from the company he was presented with a wallet of treasury notes by Mr. H. L. Satchell, M.B.E., director, manager Rugby works, on behalf of the superintendents and heads of the various departments at Rugby. A second presentation (a gardener's pressure spray) was made by Mr. E. T. Muston, superintendent of the fabrication factory, on behalf of the factory supervisory staff.

Mr. Arthur D. Bailey has been appointed manager of the Newcastle branch of Brook Motors, Ltd.

The General Committee of the British Association has elected **Dr. E. D. Adrian,** O.M., P.R.S., Master of Trinity College, Cambridge, as president of the Association for 1954. Dr. Adrian will take up office on 1st January next, and will preside at the annual meeting which is to be held in Oxford from 1st to 8th September, 1954. Dr. Adrian is also president of the Royal Society.

Mr. B. S. Lawrence has joined E. K. Cole, Ltd., as the company's press officer. Formerly assistant editor of the *British Trade Journal and Export World* he started his journalistic career on the *Southend Standard.* Mr. Lawrence is at the company's head office at Southend-on-Sea.

Mr. Kenneth Bridges, managing director of F. W. Bridges & Sons, Ltd., celebrates this year his fortieth anniversary as an organizer of trade exhibitions at Olympia, Earls Court, and other big exhibition centres. Mr. Bridges' father started the business in 1896, when he staged several exhibitions at the Royal Agricultural Hall, Islington.

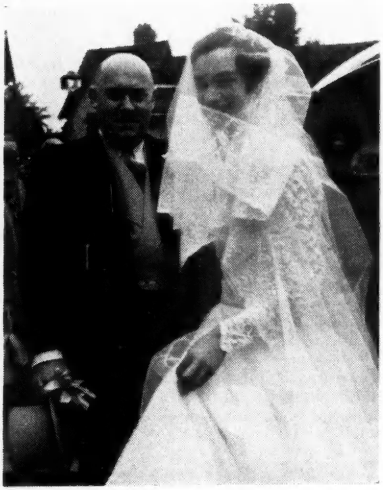
No fewer than thirty-four members of the chief engineer's H.Q. staff of the **London Electricity Board** have celebrated, since vesting day, their 25th or 35th anniversaries of joining the electricity supply industry. In addition, some members still on the staff have passed these milestones even earlier. The chief engineer, Mr. D. B. Irving, in presenting awards recently, said that it spoke well for the industry that conditions within it were such as to retain staff for these long periods. The doyen of them all was Mr. C. H. Heard, who started with the County of London and Brush Provincial Electric Lighting Co. in 1902.

Mr. J. A. Robbins, B.Sc., A.M.I.E.E., A.M.I.Mech.E., who is well known in the industry for his work on earth leakage problems and high rupturing capacity miniature circuit breakers, has been appointed technical sales manager of Chilton Electric Products, Ltd., Hungerford, Berks.

Mr. J. A. Robbins

The area final of the **Electrical Industries Benevolent Association National Golf Tournament** for the West Lancs, Merseyside and North Wales Area, was played at Heswall Golf Club on 1st September. There were forty-two qualifiers for the competition. The winner of the Britton Bowl and replica was Mr. H. Newall, Wallasey, Ches, and the runner-up was Mr. W. J. Thompson, Wrexham. The best scratch score was returned by Mr. H. R. Harding, Helsby, Ches. Messrs. Newall, Thompson and Harding have been invited to compete in the national competition at Moortown Golf Club, Leeds, on 22nd September.

Miss Lesley Scott Adie, a director of Rowlands Electrical Accessories, Ltd., was married on Friday last at St. Alphage Church, Solihull, to Mr. Peter G. Ordish. The bride, the eldest daughter of the governing director of the company, Mr. K. Scott Adie, was given away by her father. The photograph reproduced herewith was taken as they entered the church. Miss Scott Adie is resigning from the board, but will continue to act in an advisory capacity in the company's Plinth Lighting Public Relations Bureau.



Miss L. Scott Adie entering the church with her father, Mr. K. Scott Adie, before her marriage to Mr. P. G. Ordish

OBITUARY

Mr. Reginald Percy Giles died at Belvedere, Kent, on 31st August at the age of fifty. A native of Belvedere, Mr. Giles was apprenticed at the Fraser & Chalmers Engineering Works, afterwards going into the drawing office of Callender's Cable & Construction Co., Ltd. Later he transferred to the sales engineering side of Siemens Bros. & Co., Ltd., and was subsequently appointed to the staff of British Insulated Cables, Ltd. In 1947 he joined W. Lucy & Co., Ltd., as a technical sales representative in the Midland, Eastern and South Eastern areas.

Mr. R. C. Walker, B.Sc.(Lond.), A.M.I.E.E., A.M.I.Mech.E., who was in charge of technical and commercial development of photocells, Geiger Müller counter tubes and special electronic devices in the Osram Valve and Electronics Department of the General Electric Co., Ltd., died on 7th August at the age of fifty-seven. Mr Walker's first association with the company was at the Osram-G.E.C. Lamp Works Hammersmith, where he was engaged part time while taking his degree course at Reading University. In 1925 he was appointed to the technical staff of the Lamp Works, and joined the staff of the G.E.C. Osram Valve and Electronics Department in 1928. Besides writing for technical journals in this country and in New York, Mr. Walker was the author of a number of works on electronics and its application to industry.

Mr. Leonard Lewis Worthington died suddenly on 1st September, in his office at the British Thomson-Houston Co., Ltd., Rugby. Mr. Worthington was in his seventieth year, and joined the B.T.H. Co. in London in 1912. He had been engaged mostly on factory accounting and on time office work. He was the secretary of the B.T.H. (Rugby) Long Service Association, and secretary for the Rugby district of the Electrical Industries Benevolent Association.

Mr. G. Hall.—The death is announced of Mr. Gerald Hall, chief plant engineer of Ericsson Telephones, Ltd., Beeston.

Mr. W. O. Fenwick.—The funeral service for Mr. W. O. Fenwick, our Technical Editor, whose death we reported last week, took place at St. Mary's Church, Isleworth, on 3rd September. Many representatives of electrical organizations and several of Mr. Fenwick's friends of the electrical Press were present. On behalf of Mrs. Fenwick and the directors and staff of the *Electrical Review* we extend our thanks for the many messages of sympathy received and for the flowers which were sent.

WILLS

Mr. R. R. Venning, M.B.E., manager of the Lighting Fittings Department of the Light Group of Philips Electrical, Ltd., who died on 6th May, left £10,904 gross (£10,804 net).

Mr. W. F. Kent, contracts manager of the Marconi International Marine Communication Co., Ltd., who died on 9th December, intestate, left £11,869 gross (£10,460 net).

Mr. H. P. Guy, A.M.I.E.E., manager, Barnet District, Northmet Sub-Area, Eastern Electricity Board, left £6,435 gross (£6,345 net).

Mr. J. E. Percival, chairman of Pirelli-General Cable Works, Ltd., who died on 31st March last, left £53,491 gross (£52,134 net).

Mr. C. B. Taylor, superintendent of the British Thomson-Houston Co.'s King Edward Factory at Thorne, who died on 1st May last, left £3,669 gross (£2,574 net).

B.S.I. PUBLICATIONS

Prepayment Meters

SINGLE-RATE (flat-rate) and multi-rate (load rate) and two-part tariff prepayment meters for systems not exceeding 250 V are dealt with in B.S. 37: Part 3: 1953, just published, price 4s. Such types of meter combine a single-phase two-wire element with a coin-freed mechanism wholly or partially controlled by the meter. The standard ratings are 10 A and 40 A, corresponding to the maximum continuous rated current. Details are specified for the coin-register and the credit and debit indicators as well as the normal electrical requirements. Certain features recommended for incorporation in future designs of meter are included in the appendices.

Part 1, "General clauses applicable to all types of motor meter," and Part 2, "Single-phase two-wire whole current credit type meter," were published together as a single document some months ago, price 4s. Copies are available from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1.

Rubber Gloves

The 1953 edition of B.S. 697, "Electricians' Rubber Gloves," which has just been published, is unlike the 1940 edition in that it is divided into two parts. Part I deals with gloves for use on live circuits up to 250 V to earth, while Part II deals with gloves for use on live circuits of 11 kV, 33 kV and 40 kV to earth. This division has been made to emphasize the fact that, in general, work on live equipment above 650 V to earth is at variance with the Electricity (Factories Act) Special Regulations, 1908 and 1944.

Both parts of the Standard apply to gloves made either by a dipping process or from sheet rubber or from moulds. The specification gives guidance on the selection of gloves for test purposes and prescribes the appropriate electrical, mechanical and ageing properties of the gloves, together with their dimensions and the method of marking. Both parts of this Standard are issued as a single document and copies are available from the Institution, price 3s 6d.

NOTES FROM AUSTRALIA

By a Correspondent

THE Minister for Trade and Customs has referred to the Tariff Board the question of what rates of duty shall be imposed on thermostats imported into the Commonwealth of Australia. The Wilcolator Manufacturing Pty., Ltd., Melbourne, has asked that such controls for domestic appliances shall be made dutiable at the rate of 15 per cent under the British preferential tariff.

The New Zealand Board of Trade proposes to conduct inquiries into the question of rates of import duty on domestic refrigerators, washing machines and vacuum cleaners.

Imports of electrical appliances, etc., in the financial year 1951–52 (compared with those of 1950–51, in parentheses) included: Stoves, ranges, cookers and ovens, £1,864,536 (£722,970); radiators, toasters and kettles, £179,942 (£93,275); travelling and household irons, £188,107 (£124,339); industrial irons, £8,682 (£658); elements for irons, £9,777 (£362); radio receivers, excluding cabinets and valves, £160,999 (£73,139); household refrigerators, £1,914,953 (£1,201,123); other refrigerators, £180,579 (£81,196); parts, £1,428,157 (£602,099); washing machines, £4,608,700 (£2,189,405); floor polishers, £1,199,450 (£189,452); vacuum cleaners and parts, £1,964,114 (£1,069,397); household and office fans, £196,020 (£80,715) and other electric fans, £143,251 (£74,717).

NEXT WEEK'S EVENTS

Monday, 14th September

BIRMINGHAM.—Midland Hotel, New Street, 6.15 p.m. Birmingham Electric Club. Presidential Address, by C. F. Partridge.

LONDON.—St. Ermin's Hotel, Caxton Street, S.W.1, 7 p.m. A.S.E.E. Central London Branch. "Electric Tools," by N. T. Tharme.

SHEFFIELD.—The University, St. George's Square, 6.30 p.m. I.E.S. Sheffield Centre. Students' lecture, by F. A. Benson.

Monday, 14th September, to Thursday, 17th September

CARDIFF.—Drill Hall. Business Efficiency Exhibition.

Tuesday, 15th September, to Friday, 18th September

LIVERPOOL.—Association of Public Lighting Engineers. Annual Conference.

Wednesday, 16th September

GLASGOW.—125–127, Sauchiehall Street, 7 p.m. Incorporated Plant Engineers, Glasgow Branch. "Education and the Plant Engineer," by H. N. Henry.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. "Electronics in Industry," by A. Williams.

Thursday, 17th September

CANTERBURY.—County Hotel, 8 p.m. A.S.E.E. Kent Branch. "Vee Belt Drives," by J. H. Cleator.

EXETER.—Exeter Electric Club. "Twenty Questions."

LONDON.—At the Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7.30 p.m. Institution of Electronics. "Semi-Conductors," by Dr. J. S. Blakemore.

PORTSMOUTH.—At the "Air Balloon," 7.15 p.m. A.S.E.E. Portsmouth Branch. "Association Affairs," by E. A. Bromfield.

Thursday, 17th September, to Wednesday, 30th September

LONDON.—Central Hall, Westminster. National Handicrafts and Hobbies Exhibition.

Saturday, 19th September

DUNDEE.—Incorporated Plant Engineers, Dundee Branch. Visit to Kemnay Quarries, Aberdeen.

VIEWS on the NEWS

By REFLECTOR

DURING recent months I have seen many reports of complaints by hoteliers that electricity charges are too high and I have thus been reminded of the pot and kettle. Now Mr. J. W. Simpson, secretary of the British Electrical Power Convention, writes to the *Daily Mail* to call attention to the other side of the shield. Referring to the treatment of delegates to conferences he says that the charges of some hotels are exceedingly high and cause dissatisfaction. I consider this to be a very moderate way of putting it. Mr. Simpson suggests an agreed scale of hotel charges for those attending conferences. This might work an improvement, but the "extras" badly need controlling, too.

* * *

Religious susceptibilities must be respected until they overstep certain limits. An instance of this has appeared in the *Scottish Sunday Express*, which reports that twenty new lamp posts being erected in Kirkcaldy have brought a protest from a local minister. He says that they are "an affront to Christians" because they are decorated on top with a crescent moon. The reverend gentleman says:—

> "The crescent moon is the symbol of Islam—at one time the very fierce enemy of Christianity. This is a blunder in a Christian land."

An illustration printed with the report makes me feel some sympathy with the minister, but not for the reason he puts forward.

* * *

It is good to see that even the more obscure arts and crafts with long-established traditions are coming under the sway of electricity. Improving on the sailors' practice of putting models of ships in bottles, a gentleman at Hove has, after preliminary experiments with a 2in aspirin bottle, succeeded in getting the models inside electric lamp bulbs of various sizes. This has involved taking off the brass fittings without breaking the glass and passing the models through the small apertures, by which time I should think the contents of the aspirin bottle would be very welcome.

* * *

A recent note received from the International General Electric Co. of New York, Ltd., shows how much more prosperous American workers seem to be than their European counterparts. The company's "parent" concern, the American General Electric Co., is putting up a new domestic appliance factory at Louisville, Kentucky. It is said that the buildings will cover 400 acres. This is a tremendous area but, in addition, it has been necessary to purchase as much land again to accommodate the cars of the workers at the plant.

* * *

There was something Gilbertian (a lovely term for the unusual) in the situation at this year's Scunthorpe Agricultural Society's show. A supply amounting to 25 kW was needed and an electrical contracting concern (a member of the E.C.A.), which also makes automatic generating plant, was asked to provide the power. This it did by means of three of its small sets. At the same time the Yorkshire Electricity Board, whose primary job is to supply electricity, merely provided the temporary mains and wired some of the stands.

* * *

Reporting on the power supply for the Bristol Civic Show, the *Bristol Evening Post* says:—

> "Thanks to the co-operation of the S.W. Electricity Board, one of the major behind-the-scenes headaches—that of having enough light and power—has been settled for this year and always. Last year the electricity supply came from a ladies' public convenience and a generator and was taxed to the limit, but now a special underground cable has been laid to the site."

Certainly a much better arrangement.

Aircraft Electrics

Display of Equipment at Farnborough

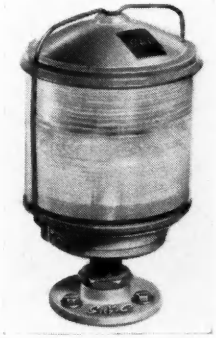
THE flying display and exhibition of aeronautical equipment and instruments which is organized annually by the Society of British Aircraft Constructors (S.B.A.C.) is being held this week (8th to 13th September) at the Royal Aircraft Establishment, Farnborough, Hants. Apart from a most impressive series of demonstrations of the latest types of both civil and military aircraft there is also a "static" exhibition which includes a comprehensive collection of aircraft engines, components, instruments and various other items relating to the business of flying. One of the main points brought out by this display is the rapidly extending use and growing complexity of electrical apparatus in aircraft and with the further development of high-speed high-flying machines it has to be made to operate at high efficiency under extremely arduous conditions.

Against a background showing the components of the electric power system designed, developed and supplied by the British Thomson-Houston Co., Ltd., for the "Comet" aircraft, there are exhibits of high-energy ignition units and turbo-starters for gas turbine engines; booster-coils; a.c. and d.c. motors and generators; magnetos; switches; circuit breakers; and voltage regulators. Another interesting exhibit is the B.T.H. electronic ignition tester for multi-cylinder piston engines. There is also a display of "Mazda" lamps and lighting equipment for use in aircraft.

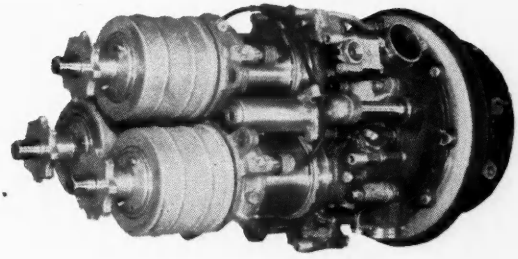
The General Electric Co., Ltd., has placed the main emphasis on airport lighting, aircraft galley equipment, and G.E.C. heavy alloy. The British "line and bar" approach lighting system, which complies with the latest recommendations of the International Civil Aviation Organisation, is demonstrated by a model illustrating a pilot's view of airport approach, runway and taxiway lighting. One new item is a low intensity runway and taxiway light, which has been designed for the lightest weight (1 lb) consistent with reliability and provides the minimum risk to aircraft. No glass is used, the optical system comprising a cylindrical "Perspex" prismatic refractor which gives the desired light distribution in conjunction with a 36 W prefocused lamp.

The exhibits of Ferranti, Ltd., include gyroscopic gunsights, an aircraft simulator for training airfield controllers without the use of actual aircraft, an airstream direction detector, an electronic digital computer and a gyroscopic horizon of superior performance. In this instrument complete freedom from the effects of altitude, temperature variation and the ingress of dust and moisture has been achieved by

G.E.C. airport lighting unit



B.T.H. three-shot turbo starter



using an electrically driven gyro and a hermetically sealed case.

Thorn Electrical Industries, Ltd. (Aircraft Components Division), have been licensed under the patents of Plasteck Incorporated, U.S.A., as sole manufacturers in the United Kingdom and British Commonwealth of a new system of cockpit console lighting to be known as "Thorn Plasteck." It makes use of an indirect red light of a specific wavelength and gives better cockpit illumination combined with greater ease of operation and reduced personnel fatigue.

The exhibits at the Venner Instrument stand include aircraft instruments, coders for aerodrome beacons and timing equipment applicable to aircraft factories. At the Venner Accumulator stand are the latest ultra-lightweight accumulators, and a new aircraft emergency lighting unit. This is entirely self-contained incorporating a lightweight accumulator, inertia switch and external setting and test switch. The control switch closes to illuminate the lamp when subjected to a specified deceleration in any direction in a horizontal plane. The accumulator will light the lamp for a minimum period of 1 hour and it can be easily detached from the cabin interior for use as a portable lamp.

The range of lighting equipment developed by the Revo Electric Co., Ltd., for airfield lighting comprises various types of obstruction lights, floodlights, unidirectional and omni-directional approach lights for pole or ground mounting, elevated and sunken taxiway lights, sodium flares, cut-off fittings for roadway lighting, transformers and control gear for use with the appropriate fittings.

Among the diverse range of products shown by Salford Electrical Instrument, Ltd., is a new equipment which enables even an unskilled operator to make rapid precision frequency measurements by direct reading. The range extends from 10 c/s to 10 Mc/s and the accuracy of observation is better than 1 c/s plus the error of the source of standard frequency.

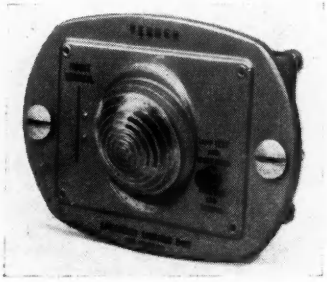
A radar sonde equipment, likely to be of great importance for obtaining information about weather conditions in the upper air, is the principal exhibit on the Mullard, Ltd., stand. A complete radar wind and radar sonde system, comprising a fully automatic ground station and two types of balloon transponder, has been developed and visitors can see, with the aid of an animated diagram, the basic principles of operation. A collection of components for a wind transponder is also shown.

Among the several new developments shown by Kelvin & Hughes (Aviation), Ltd., are an air mileage unit, a precision engine speed indicator for jet aircraft where the requirement for accuracy is ± 2 per cent, a sensitive altimeter with a counter barometric scale, a transonic machmeter, a damped accelerometer, a rate of climb indicator and a turn and slip indicator. On the English Electric stand is a display of actuators, invertors, and both a.c. and d.c. motors and generators.

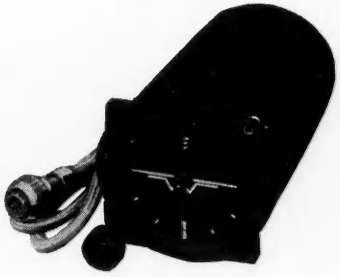
A modern universal aircraft servicing and starting mobile unit is shown which is capable of starting every class of aircraft in service at present or coming into service in the foreseeable future. It is the result of collaboration between B.O.A.C., Auto Diesels, Ltd., and Crompton Parkinson, Ltd.

The unit consists of a diesel engine

Venner aircraft emergency lighting unit



Ferranti electric gyro horizon



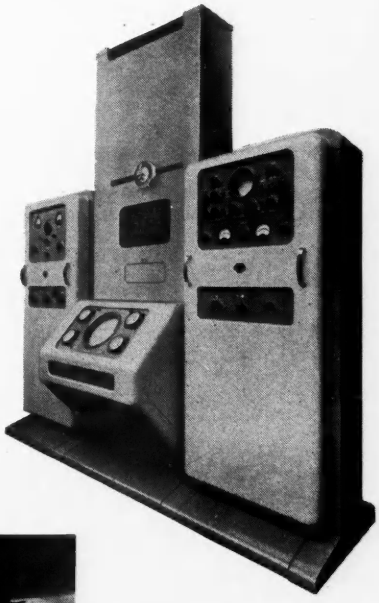
driving two generators giving outputs of 450 A continuously at 112 V; and 750 A continuously at 28 V. In addition the unit will supply peak starting currents of 850 A at 112 V and 2,000 A at 28 V. Simultaneous outputs for 28 V servicing and 112 V starting are permissible up to 100 kW. The unit is mounted on a trailer enclosed in an all-weather body of modern design.

An interesting item displayed by the Plessey Co., Ltd., is a radio tele-typewriter receiving terminal which is the first adaptable multi-channel equipment for stabilized reception of frequency shift keying. It may be assembled, unit by unit, to form any number of remotely controlled channels. Fulfilling the stringent I.C.A.O. requirements for aeronautical fixed telecommunication networks, the equipment is designed for unattended operation, providing four channels in the band 2–20 Mc/s. Apart from other radio equipment the company also has on view a liquid fuel starter for turbine engines and the Napier-Plessey h.f. ignition system.

Marconi's Wireless Telegraph Co., Ltd., shares adjoining stands with its Australian associates, Amalgamated Wireless (Australasia), Ltd. The combined stands emphasize the work of the two companies, equally between airborne and ground radio and navigational aids. There is a control desk for use by air traffic controllers at airports, remotely controlled multi-channel v.h.f. transmitter-receivers, an h.f./m.f. high discrimination receiver, an 8-channel h.f. transmitter-receiver and a 120-channel crystal locked receiver.

Apart from multi-channel airborne communication equipment a frequency modulated radio altimeter and airfield lighting

Revo watertight transformer



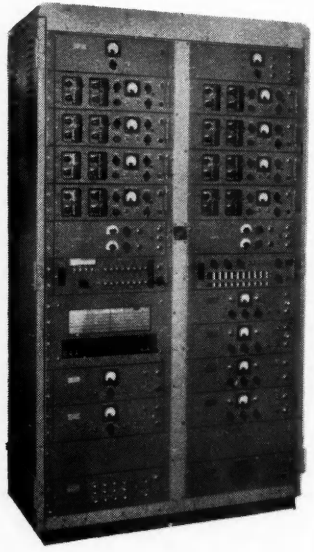
Mullard radar sonde equipment

B.O.A.C.-Auto Diesels-Crompton Parkinson ground power unit

control systems, Standard Telephones & Cables, Ltd., are showing "SenTerCel" selenium rectifiers of specially small size and low weight for use in aircraft. There is also a selection of h.v. aluminium rectifiers and a mobile aircraft engine starter having an output of 2,000 A d.c. at 24 V for 2 sec and 900 A at 27·4 V during cranking. An alternative output of 400 A continuously at 28 V is available for testing purposes.

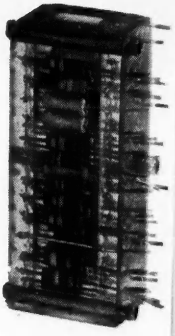
The Westinghouse Brake & Signal Co., Ltd., shows a "Westruk" engine starter, designed to provide 300 A d.c. continuously at 28 V for operating electrical equipment on grounded aircraft, and will also provide a peak output of 1,500 A for engine starting. Lightweight aluminium-based rectifiers are also on view, together with germanium crystal diodes and an automatic announcer, for use at aircraft termini or any dispersal point where repetition announcements would be made.

A disadvantage of externally mounted aircraft aerials is the "drag" when applied to high-speed aircraft. The suppressed aerial shown by Ekco Electronics, Ltd., overcomes this because it is within the structure of the aircraft. Suitable for use with either 12 or 24 channel transmitter/receivers, it operates successfully at high altitudes due to the fact that there is a considerable reduction in corona troubles associated with thin-section external aerials.



Plessey radio tele-typewriter receiving terminal

Electrical components potted in Bakelite polyester resin



Plastics in many of the different forms in which they are produced by Bakelite, Ltd., are used in the aircraft industry, and because they are capable of wide but controlled variation, they are increasingly important in meeting new operating conditions. Recently new materials for new purposes have become available and a number of these are displayed, in addition to aeronautical applications of the company's standard products.

The plastic products shown by Ashdowns, Ltd., include a variety of "Fibreglass" reinforced laminates incorporating phenolic, melamine, silicone and polyester resins. Also shown are the "Ashlam" copper-clad laminates used for the production of printed circuits, and various paper and cotton cloth laminates for electrical and mechanical insulation together with "Perspex" and p.v.c. fabrications and plastic mouldings.

Among the exhibits of British Insulated Callender's Cables, Ltd., are a comprehensive range of aircraft cables, including the "Pren" type which is insulated with poly-chloroprene and is for wiring where normal temperatures are encountered. For special conditions there are "Glasil" cables, insulated with silicone-rubber, which are suitable where the operating temperature is between −50 deg C and +150 deg C, and "Glasef" cables, insulated with p.t.f.e., for operating between −75 deg C and +250 deg C.

Comprehensive ranges of aircraft batteries of all types are shown by Chloride Batteries, Ltd., Oldham & Son, Ltd., and Peto & Radford, Ltd. A range of new and improved valves for aircraft pneumatic systems are exhibited by the Hymatic Engineering Co., Ltd.

Engineering in Europe

Survey of Current Literature

THE German regulations VDE0100 and VDE0140 have been redrafted, but it was found that five additional protective measures incorporated in the new drafts were not made sufficiently clear to prevent cases of incorrect application which might even introduce additional dangers. A questionnaire was therefore circulated to 86 power stations, serving 5 million consumers, about the details of the protective methods and measures taken by them and experience gained in this field. The results show that earthing through the neutral in l.v. systems is a very convenient method but is quite safe only if the neutral of every service unit is connected to water mains. Also, all the water supply and waste and central heating pipes should be interconnected in this case.

Experience with protective switches against contact voltages was generally unsatisfactory, particularly in damp rooms. Some difficulties also arose from the incompatibility of earthing through neutral and direct earthing. It is the general opinion that additional insulation should be used on a much larger scale than heretofore. The special section of the article collects instructive cases illustrating the general principles established.—" Problems in the Field of System Protection, arising Particularly in Connection with Earthing through the Neutral," K. Schneider, *Elektrizitätswirtschaft*, Vol. 52, No. 13, pp. 329–335, 5th July, 1953, in German.

Long D.C. Line Calculation

A ring-type d.c. line (e.g., one or more electrolytic tanks in series, or the stray currents in a tramway system) with two "critical points" is considered. At the first point, whose position is given, there is a concentrated conductance to earth; the second point is at zero potential and its leakage conductance has a discontinuity. Thus the position of the second point cannot be chosen arbitrarily, but has to be found by calculation, just as the current and power losses arising there.

Although an elementary method for solving this problem has been suggested by Podolskii, who assumed the current to remain constant all over the line, with infinitely small leakage and uniform fall of the potential, the formulæ obtained are awkward to handle and their accuracy is quite fictitious, considering the artificial assumptions. The method presented in the paper is accurate and based on the theory of a long transmission line. For the case of small losses the formulæ are susceptible of considerable simplification, and the treatment is mathematically more accurate, because it permits considering a discontinuity of the resistance as well as of the conductance in the point at zero potential.—" Calculation of a Long D.C. Line where its Parameters Depend on the Sign of the Potential," N. A. Rostovtsev, *Elektrichestvo*, No. 5, pp. 62–66, 1953, in Russian.

Insulating Oil Conductivity

A method of measuring very small currents and very high resistances ($0{\cdot}5 \times 10^{-12}$ A and 1 MM Ω, respectively) has been worked out and used for measuring the conductivity of insulating oils. For a constant applied p.d., the effect of a rising temperature will be to reduce the conductivity of a moist oil in proportion as the moisture disappears, whereas the conductivity of a dry oil increases roughly in an inverse proportion to the viscosity of the oil. There is a minimum of conductivity where the effect of the viscosity compensates for the elimination of the moisture.

A moist oil has a very high resistance at low field strengths which decreases roughly according to a hyperbolic law when the field is increased, whereas a dry oil attains its maximum of resistivity at weak fields and drops only insignificantly from this value as the field strength increases. This effect has a character reminiscent of Weiss' law in electrolysis. The time relation investigated with a constant p.d. applied was characterized by a current falling with time to a practically constant value I_F,

which character was maintained at various temperatures and field strengths.

The quotient V/I_F is a linear function of V, but not of I_F. This fall seems to be due mainly to the accumulation of charges near the electrodes which reduce the applied field. If the p.d. reducing the current to the value I_F is suppressed, the oil recovers its original state by a process similar to a diffusion phenomenon, in which the charged particles previously accumulated near the electrodes are dispersed through the oil until the initial electrical homogeneity of the latter is re-established.—" Investigation of the Conductivity of Insulating Oils as Function of the Temperature, the Electric Field Applied, and Time, if the p.d. Applied is kept Constant," R. Guizonnier, *R.G.E.*, Vol. 62, No. 5, pp. 247–254, May, 1953, in French.

Wind Stresses in Overhead Lines

Three methods were used for measuring the stresses set up by the wind in the conductors of a 60 kV three-phase overhead line section 960 m long supplying a traction substation of the French Railways. The first method was to measure the tensile stress of the conductors, the second to measure the linear displacement of a counterweight attached to a special test conductor the tension of which was kept constant while it was exposed to the wind; the third method consisted in measuring the inclination of the insulator strings under the effect of the wind.

The comparison and correlation of the results of these measurements led to interesting conclusions regarding the possibilities of an effective supervision of the mechanical stress conditions of overhead lines and also regarding the suitability of the methods tried out. The fundamental fact is that only continuous measurements and recordings may convey an idea of the stress processes during service and even then only when combined with simultaneous anemometric measurements.

As to the methods and instruments used, it may be stated that dynamometer methods of measuring conductor tension are reliable if the dynamometers are sensitive enough. The inclination angle of the insulator chains may furnish valuable additional data and could be used for a certain kind of check, though it does not help to obtain information on conditions in the middle of a span. The method of the counterweight is satisfactory and could be made self-recording and sufficiently sensitive by using a long test conductor with a tension reduced to the minimum compatible with the height above ground to be observed. – " Experimental Investigations of the Wind Stresses in Overhead Line Conductors," M. Jacquet, *R.G.E.*, Vol. 62, No. 5, pp. 223–232, May, 1953, in French.

Rapid-Reclosing Tests

The statistics of transient faults cleared by rapid reclosing are very favourable, 80 per cent of all cases being cleared successfully without interruption of the supply. It should be remembered that on an average 70–80 per cent of all faults are transient faults. On the other hand, such satisfactory results may be achieved only by using up-to-date rapid-reclosing gear, appropriately placed in the system, special consideration being given to interconnections; the correct setting of the installations must also be determined by short-circuit tests taking into account a wide variety of possible events of varying severity.

This article deals mainly with such tests carried out on interconnected 100 kV lines and 22 kV interconnectors, and with the evaluation of the test results. For 100 and 220 kV the available type of circuit breaker, viz. expansion type, was found to be suitable for rapid reclosing, whereas the corresponding types cannot be used for rapid reclosing in 22 and 35 kV systems. For the latter voltages air-blast circuit breakers were found more appropriate.

The author stresses in his introduction the necessity of economic considerations before installing and adjusting rapid-reclosing gear, since the outlay for this type of equipment tends to be considerable unless the circuit breakers are of modern types suitable for rapid reclosing without requiring additional installations. Also, the type of system protection used, and whether or not quenching coils are used, must be taken into consideration when deciding on the installation of special rapid-reclosing gear.—" Automatic Reclosing in V.H.V. Systems," B. Stedry, *Elektrotech. Obz.*, No. 2, pp. 93–103, February, 1953, in Czech.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

COMMERCE and INDUSTRY

Engineering and Marine Exhibition Opened

Safety Rules for Householders

THE Engineering, Marine and Welding Exhibition which, together with the Chemical Plant Exhibition, is being held at Olympia, London, until 17th September, was officially opened on Thursday last week by Mr. D. D. Walker, president of the British Engineers' Association and chairman of the British Electrical and Allied Manufacturers' Association. The exhibits (reviewed in our last issue) cover an area of more than 250,000 sq ft. A number of the 500 stands were without mains electricity as a result of the electricians' strike, but some of the electrical manufacturers were able to overcome the difficulty by employing their own power plant. A Ruston & Hornsby industrial gas turbine was used to supply much of the exhibition lighting.

Mr. Walker remarked that when the last exhibition was held two years ago the main problem was production: the sellers' market was then with us. To-day the position had altered considerably, and we were faced with growing competition in overseas markets. Our manufacturers had every confidence in the quality of their products. Boldness in design was not lacking, and there were many examples of developments in which we led the world. What was needed to-day was boldness in selling.

At the inaugural luncheon following the opening ceremony Sir James Helmore, Permanent Secretary to the Ministry of Supply, spoke of the tremendous development in gas turbine engines.

Electrical Orders from Russia

Mr. Sydney Lane, a director of the Brush group, has recently returned from a twelve-day visit to Moscow, where he negotiated business to the value of more than £3 million for the Brush group, subject to the grant of export licences. The group is to supply diesel-electric generating sets, transformers and other electrical plant. The companies in the group who share this business are the Brush Electrical Engineering Co., Ltd., the National Gas & Oil Engine Co., Ltd., Petters, Ltd., Hopkinson Electric Co., Ltd., and J. & H. McLaren, Ltd.

Blackpool's Luxury Tramcars

Within the next two or three weeks, ready for use during the period of the illuminations, the last of the fleet of 25 single-deck luxury tramcars made by Charles Roberts & Co., Ltd., for Blackpool Corporation will be delivered. It is claimed that these vehicles, which have cost over £10,000 each, are the most modern and comfortable of their type in any country, and with a roof which is two-thirds glass, they allow the maximum amount of sunlight to enter and are ideal for providing the fullest possible view of the illuminations. They run very silently on their specially-tyred wheels and have a braking system which is both powerful and smooth.

Safe Installation Work

In co-operation with the Electrical Contractors' Association the Royal Society for the Prevention of Accidents has produced a leaflet with the object of preventing electrical mishaps in the home. It is intended for distribution to householders and gives simple rules for avoiding trouble, e.g., periodical checks on wiring and equipment, keeping portable appliances out of bathrooms, never using a lampholder or lighting plug for the heavier domestic appliances and banning "amateur" wiring work. Above all the necessity for employing properly qualified contractors is stressed.

The R.S.P.A. has also designed a coloured poster for use in shop windows, on vans and at exhibitions with the theme "His Efficiency Your

Electrical safety poster by the R.S.P.A.

Safety—Employ a Qualified Electrical Contractor." Supplies of the leaflet and poster are obtainable from the Royal Society for the Prevention of Accidents, 52, Grosvenor Gardens, London, S.W.1.

Electricity "At Home"

A new form of "At Home" is being arranged by the South-East London Branch of the Electrical Association for Women, who on 15th, 16th and 17th September, invite interested members of the public to try out the latest types of electrical apparatus in the Lewisham Town Hall, Catford, S.E.6. The apparatus will be grouped in sections relating to the man, woman and child; cleanliness and hygiene; electricity in times of illness; cookery and laundry; the garden and workshop. Women can assess the practical merits of new types of electric washers, food mixers, cookers, cleaners and miscellaneous appliances, while their husbands can sample electricity's efficiency in the home workshop and garden. The "At Home" will be opened by the Mayor of Lewisham, and Dame Caroline Haslett will speak.

Stage Lighting

Amateur stage production calls for the best use of the lighting facilities available, and amateur producers will therefore find "Further Advice on Stage Lighting," published by the Strand Electric & Engineering Co., Ltd., 29, King Street, London, W.C.2 (price 2s 6d post free), a valuable guide. The booklet is a reprint of "Some Advice on Stage Lighting," issued five years ago, but the new publication has a second part added to it to increase its scope in several ways, including tables showing the beam angles and relative intensities of standard stage lighting lanterns, and further information on the choice, erection and adjustment of the lanterns.

The company has also issued, free of charge, a pamphlet entitled "Black Light—Fluorescent Paints and Materials," with notes on its use in the theatre.

Television Equipment Order

The Swiss broadcasting authorities (P.T.T.) have ordered a complete television outside broadcasting vehicle from Marconi's Wireless Telegraph Co., Ltd., for delivery within nine months, so that the European Football Championships can be televised from Berne in June, 1954. This unit is the second stage in the Swiss authorities' plans to provide the country with television, of which the Zurich station is the first. The unit will contain three camera channels, i.e. three Marconi "Image Orthicon" cameras with their appropriate controls, mixers, and sound mixing equipment.

Street Lighting Booklet

Coincident with the Conference of the Association of Public Lighting Engineers, which is being held in Liverpool next week, the General Electric Co., Ltd., has issued a brochure entitled "Street Lighting by G.E.C.", which, after a brief review of the part the company has played in the design and manufacture of street lighting equipment, contains a selection of day and night photographs of installations in Great Britain and overseas, illustrating the diverse nature of the work undertaken by the company.

London Wholesalers' Showroom

On 2nd September Miss Elizabeth Allan performed the opening ceremony of the new showroom and radio exhibition of L.E.S. Distributors, Ltd., at 15–16, Alfred Place, London, W.C.1. In reality it was a re-opening as the company had a showroom at this address before the war. The premises were requisitioned, however, and now, after some reconstruction and redecoration, the showroom is once again available to electrical contractors and the trade generally. The display is main'y domestic and is divided into sections each showing

Part of the new showroom of L.E.S. Distributors, Ltd.

apparatus for use in the home. In addition there is a display of portable electric tools and a comprehensive section devoted to radio and television sets.

British Trade with Burma

In a review of commercial conditions in Burma, published by H.M. Stationery Office at 1s net, it is stated that the foreign trade of Burma is below normal at present because parts of her territory are still either in insurgent hands or at the mercy of insurgent raids. United Kingdom trade with Burma, however, improved in 1952 for which year its total value of imports into Burma was £15,213,000. The value of United Kingdom trade with Burma for the years 1948 to 1952 is set out in a table which shows that imports of electrical goods and apparatus were as follows:—1948, £516,000; 1949, £334,000; 1950, £409,000; 1951, £536,000; and 1952, £876,000.

Skegness Illuminations

In our last issue we referred to the Skegness autumn illuminations. We are informed by "Beeantee" Illuminations (London), Ltd., that it supplied 11,000 "Beeantee" holders, flower bed floodlights, all-electric colour changing spotlights, wide angle floodlights, general purpose floodlights, "E.R." monograms with crown, scintillators, animated set pieces, and many special flashers.

"Heat and Light in the Home"

The 5th September issue of *Picture Post* contains a 10-page section entitled "Heat and Light in the Home" which includes articles on the decorative and functional aspects of lighting and on the relative efficiency of different types of heating equipment.

Prompt Delivery

Two 64in electric lifting magnets were ordered by a Canadian firm from the Witton-Kramer electric tool and hoist works of the General Electric Co., Ltd., for loading scrap iron into ships at Montreal Pier. Only fourteen days after the order had been received in England the magnets were in service in Canada. Since that time, four further magnets, one of 64in, two of 36in and one of 26in diameter have been delivered at Montreal equally promptly.

B.O.T. and M.O.S. Regional Offices

As already announced, the regional offices in England of the Board of Trade and Ministry of Supply are being combined. The actual date will vary according to the circumstances in each region and will be announced separately in the *Board of Trade Journal*. The combined offices will also continue to act for the Ministry of Materials. The President of the Board of Trade, in consultation with the Minister of Supply, has appointed the following to act as controllers of the combined offices:—Northern, Mr. K. G. Sillar; East and West Ridings, Mr. J. Paterson; North Midland, Mr. M. Weber; Eastern Region, Mr. G. Roberts; London and South Eastern, Mr. C. S. Toseland; Southern, Mr. F. A. Swann; South Western, Mr. J. H. Larrard; Midland, Mr. B. W. T. Kay; North Western, Mr. E. J. Holford-Strevens.

Call-Up of Students

To secure release from the Forces in time to enter university at the beginning of the academic year in 1955, students should be called up by mid-September or at latest in the first week of October, 1953. Those who have not yet been medically examined should inquire immediately at the local office of the Ministry of Labour and National Service at the address shown on their Certificate of Registration (N.S.2). Those who have had their medical examination, but have not yet received their enlistment notice should also inquire as to their position. Young men who have completed their university course before entering the Forces, and now wish to be called up without delay should, unless they have already done so, notify the Ministry of Labour and National Service (M.R.2), 23, Cumberland Terrace, Regent's Park, London, N.W.1.

Agency in Hong Kong

K. G. Nair & Co., manufacturers' representatives, 33, Queen's Road Central, 2nd Floor, Hong Kong, who are at present handling American electrical equipment exclusively, are anxious to represent British manufacturers of radio and electrical goods.

New E.A.W. Branches

Two new E.A.W. Branches were recently formed at Redditch and Hereford. The Redditch inaugural meeting was held in the Council Chamber, when the chair was taken by Mrs. A. Taylor, President of the new Branch. The Branch chairman is Mrs. R. Hodges; hon. secretary, Mrs. G. A. Paisley; hon. treasurer, Mrs. D. H. Bailey; and magazine secretary, Mrs. Trout.

The Hereford meeting was held in the Town Hall, when the Deputy Mayor was present, and the Deputy Mayoress, Councillor Mrs. Higginbotham, became the chairman. The hon. treasurer of the new Branch is Mrs. W. G. Ellson, and the magazine secretary, Mrs. V. Rich.

Conference on Welded Structures

A conference to review present knowledge of, and outstanding problems encountered in, the design, fabrication and erection of welded steel

structures is to be held at the Institution of Civil Engineers in London on 23rd to 27th November, inclusive. The organization is being undertaken by a joint committee appointed by the Ministry of Works with the support of other Government Departments and the sponsorship of fifteen engineering bodies, including the I.E.E. Forms of application for registration (fee: £2 10s) are obtainable from the conference secretariat at the Institution of Civil Engineers. Eleven topics have been chosen for discussion: each author will introduce his own paper and briefly reply after the discussion.

Electrical Fatalities

It was stated at an inquest on a Halifax plasterer that the earth pin of the plug attached to the drill he was using was missing. There was also a mechanical defect in the drill itself which would have caused the fuse to blow if the plug had been in order; instead, the casing of the machine became electrified, and he received a fatal shock.

At an inquest at Barry on a 12-year-old girl the coroner drew attention to "the extreme danger of anyone not properly qualified interfering in any way with the electric wiring installation of a house." It was stated that the girl received a fatal shock from an electric iron. At the time she was not wearing shoes or stockings and was standing on a stone floor. An installation inspector said that the earth lead was not connected and there were a number of irregularities in the wiring.

Lighting of the Old Bailey

In our issue of 28th August details were given of the lighting in the reconstructed Court No. 5 at the Old Bailey. The London Electric Firm, Ltd., tells us that it worked in close co-operation with the Edison Swan Electric Co., Ltd., in the design and manufacture of the special raising and lowering gear to which reference was made in the article.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £150 0s 0d
COPPER, H.C. Electro	ton £230 0s 0d
Fire Refined 99·70 per cent ..	ton £229 0s 0d
Fire Refined 99·50 per cent ..	ton £228 0s 0d
COPPER Tubes	lb 2s 3½d
Sheet	ton £284 10s 0d
H.C. wire and strip	ton £258 15s 0d
LEAD, English	ton £94 10s 0d
Foreign	ton £93 0s 0d
MERCURY	flask £70 10s 0d
TIN	ton £615 0s 0d
ZINC, G.O.B. Foreign	ton £69 0s 0d
Electrolytic	ton £70 5s 0d
BRASS Tubes	lb 1s 9½d
Sheet	ton £230 0s 0d
Wire	lb 2s 5½d
PHOSPHOR BRONZE	
Wire	lb 3s 7½d
RUBBER, No. 1 R.S.S. spot ..	lb 19½d–19¾d

Catalogues and Lists

Smiths Press Production Works, Ltd., 96, Bath Street, Birmingham, 4.—Priced leaflet illustrating the "Express" vacuum cleaner.

High Duty Alloys, Ltd., Slough, Bucks.—Technical booklet containing data sheets on "Magnuminium" cast and wrought alloys.

Air Control Installations, Ltd., Ruislip, Middx.—Illustrated catalogue relating to the "Electro-PL" air filter (B.531) and a leaflet dealing with small cast blowers (FB.532).

Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London, E.C.4.—64-page illustrated booklet dealing with Sturtevant electrostatic precipitation (7007).

J. Day & Co. (Derby Works), Ltd., Harrow Manor Way, Abbey Wood, London, S.E.2.—Two leaflets covering a range of "Davu" p.v.c. cables and flexibles.

Hellerman, Ltd., Tinsley Lane, Crawley, Sussex.—Illustrated catalogue dealing with the "Hellerman" binding system (BH.28).

Trade Announcements

The London office of **G. & J. Weir, Ltd.**, is removing to-morrow (Saturday) to Dunster House, 37, Mincing Lane, E.C.3 (telephone: Mansion House 1985).

The Bristol office of the **English Electric Co., Ltd.**, has been transferred to 74/76, Broadmead, Bristol, 1 (telephone: Bristol 27304). The Television and Domestic Appliance Service Department will remain at 155, Whiteladies Road, Bristol, 8 (telephone: Bristol 38253/4).

The recently formed **Whitehead Chemical Co. (Waxes), Ltd.**, with sales offices at Midland Bank Chambers, 77, King Street, Manchester, 2 (telephone: Blackfriars 8501), is now marketing the specialized and technical waxes manufactured by the Whitehead Chemical Co., Ltd. The sales office is under the direction of Mr. R. W. Hague and the laboratory and works at Holt Mill Road, Waterfoot, Rossendale, Lancs (telephone: Rossendale 1751/2) are under the supervision of Mr. J. Waldie.

J. Day & Co. (Derby Works), Ltd., has arranged for C. L. Owen, Ltd., of 1 and 2, Castle Cottages, Longbrook Terrace, Exeter, to act as its agents and distributors for "Davu" wires and cables in Cornwall, Devon, Somerset, Dorset, Hampshire, Wiltshire, Gloucester and South Wales.

Owing to extensions at their Wembley Works, the general office, home sales and exports departments of **Truvox, Ltd.**, are now temporarily situated at 15, Lyon Road, Harrow, Middx. (telephone: Harrow 9282).

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Hair Dryer

AN addition to the range of electrical appliances made by MORPHY-RICHARDS, LTD., St. Mary Cray, Kent, is a neat hair dryer of streamlined design. It is quiet in operation, and incorporates a small induction motor which the makers claim will not cause interference

Morphy-Richards streamlined hair dryer

with radio or television reception. The lightweight all-plastic case is available in two colours, grey or ivory, and each 7ft of two-core flex is provided. The price is £2 9s 6d, plus 9s 3d purchase tax in the United Kingdom, for the grey plastic model, the ivory dryer retailing at £2 14s 6d, plus 10s 2d purchase tax.

Reversible Fan

A reversible fan brought out by VENT-AXIA, LTD., 9, Victoria Street, London, S.W.1, combines the qualities of the original extract and intake units, and has the advantage of five-speed control in either direction of air flow and greatly increased air movement for smaller current consumption.

Improved performance has been achieved by a more powerful motor, an impeller of new aerofoil section and re-designed louvres and shroud. The main advantages over other forms of ventilation are: no structural work required for installation, extremely low running cost, silence in operation, practically no attention required, and complete control (including reversibility) over the individual ventilation units. With five-speed reversing switch the fan costs £12 10s for a 6in, £16 for a 7½in, £19 for a 9in and £26 for a 12in model.

Vent-Axia reversible fan and controller

New "Crompton" Battery

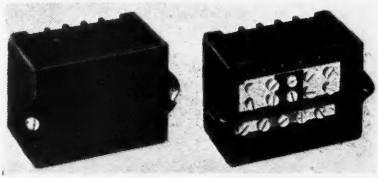
A new "Crompton" car starter battery has been introduced by CROMPTON PARKINSON, LTD. The grid made from "Nilcrode" alloy retains the active material more securely, stays rigid and resists corrosion, and a new formulation of active material gives increased power, especially for cold starting. In order to realize the longer life obtainable from the new plate, Crompton car batteries now incorporate "Dri-Stor" microporous separators which are virtually indestructible and completely unaffected by immersion in acid. Every container is made of moulded hard rubber capable of withstanding rough handling and continual vibration without cracking and resultant leakage.

Other features include larger connector bars with increased sectional area to give a higher starting voltage; and non-splash vent plugs with finger grips designed for easy, speedy unscrewing. The battery has an unlimited shelf life and can be stored unfilled for an indefinite period without deterioration.

Insulated Connector Box

A neat and compact multi-way double-pole insulated connector box designed for use in situations where it is necessary to connect a number of sub-circuits to a main circuit has recently been placed on the market by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 51/53, Hatton Garden, E.C.1. Each connector is

Multi-way insulated connector box (left) with cover removed showing connector blocks (right)



suitable for three conductors up to 0·0225 sq in and two up to 0·04 sq in.

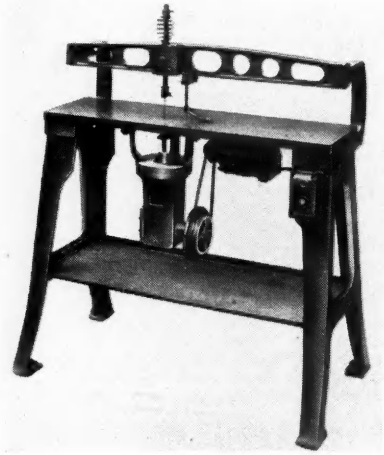
The complete box consists of two units which fit neatly together, with a common reversible cover to protect the live metalwork of both units. This arrangement allows the two connectors to be separately housed and, at the same time, phase and neutral cables for each circuit connected into the box can be arranged adjacent to each other, thus making provision for neat and readily identifiable wiring. In addition, coloured identification tabs are provided on the phase and neutral connectors. Overall dimensions of the box are: length 2⅛in, width 3 7/16 in, depth 2 3/32 in.

" All-Purpose " Saw

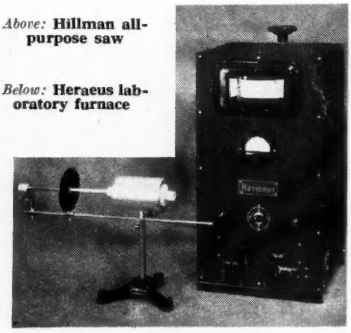
An electrically-driven high-speed saw and filing machine introduced by HILLMAN ELECTRIC MOTORS, 2–3, Northwold Road, London, N.16, is designed to handle a variety of materials from cast iron to hardwoods.

Although it is capable of continuous heavy-duty service the saw is also adaptable for very delicate work. The rigid suspension of the blade minimizes vibration and the saw holder swivel for fixing in any position; they take blades up to ¼in in width and will hold flat and round files.

The length of the table is 3ft 3in, the width 10½in, the distance from the bridge to the table 5½in, the cutting height 1⅜in, and the swing around the saw blade 16¼in and 23½in respectively. The length of the saw blade to be used is 5 or 6in.



Above: **Hillman all-purpose saw**



Below: **Heraeus laboratory furnace**

The " Dalarm " Bell

A new product of JOHN DAVIS & SON (DERBY), LTD., All Saints Works, Derby, is the weatherproof " Dalarm " a.c. bell for signalling purposes in mines and other industries. Types are available for operation directly from a.c. mains at from 25 to 250 V, 30 to 60 c/s, consuming between 70 and 100 mA. A solenoid movement is employed and the 16½in gong of pressed steel, with one or two glands or bushes, is carried on a single cast iron base which is 26½in long, 16½in broad and 5½in deep, overall.

Laboratory Furnace

A small laboratory furnace, combining ease of manipulation with relatively low initial cost, has been produced by the German manufacturers, W. C. HERAEUS of Hanau. This muffle electric resistance furnace will operate for practical periods at temperatures up to 1,800 deg C in air. No water cooling, special atmospheres or vacuum protection are required for the heating element and its connections. Pure rhodium is used for the hot-zone heating element, connection thereto being made by platinum conductors.

The diameter of the muffle on the inside is 25 mm, the hot-zone length 250 mm, and the overall length 300 mm. External dimensions of the tube furnace are 140 mm diameter and 278 mm long. The loading is about 1 kW. A smaller 600 W furnace is also available and transformers and ancillary control equipment can be supplied. Inquiries should be addressed to MR. S. H. PARSONAGE, A.M.I.E.E., 117, Chalkhill Road, Wembley Park, Middlesex.

Trolley-bus Route Extension

WOLVERHAMPTON Town Council is to be asked at its meeting on 28th September to approve of application being made to the Minister of Transport for an extension of the Wednesfield trolley-bus route. It is proposed to extend the route from the present terminus at the junction of Lichfield Road and Wood-end Road, along Lichfield Road for a distance of about three-quarters of a mile. The cost of the installation of the overhead equipment is estimated at £3,000.

A.C. Mine Winders

New Speed Control Scheme

THE ideal system of control for an electric winder provides a direct relationship between the steady rope speed and the position of the driver's power lever, at the same time affording complete protection against excessive torque no matter how the power lever is operated. Before the G.E.C. system of speed control was introduced there was no scheme for a.c. winders which fully satisfied these fundamental requirements. They are claimed to be completely met by the scheme described below. Driving, dynamic braking and reverse-current braking are obtained by a power lever operating in a single slot, and where load conditions permit, regenerative braking is available at maximum winder speed.

So long as the winder motor runs at the pre-selected speed, the control gear is in equilibrium, but any change disturbs this state and the speed is automatically adjusted until balance is re-established. Quick movement of the lever from "stop" to any position causes the maximum safe torque to be developed by the motor until the selected speed is reached, after which this speed will be maintained irrespective of load, dynamic braking being applied automatically if the load calls for it.

Similarly, a quick movement of the lever from "full speed" to an intermediate position will apply dynamic braking until the selected speed is reached, after which this speed will be maintained automatically by driving or braking as needed. Movement of the lever from "forward" through "stop" to "reverse," or vice versa, will apply reverse-current braking.

The scheme can be understood most readily by considering it under four main headings:—(1) The rotor control system, which automatically adjusts the resistance in the rotor circuit to the correct value for any conditions of speed and load. (2) The speed signalling system, which compares the speed selected by the driver with the actual speed at any moment and passes a suitable impulse or signal to the rotor control system. (3) The excitation system. (4) The working of the scheme as a whole.

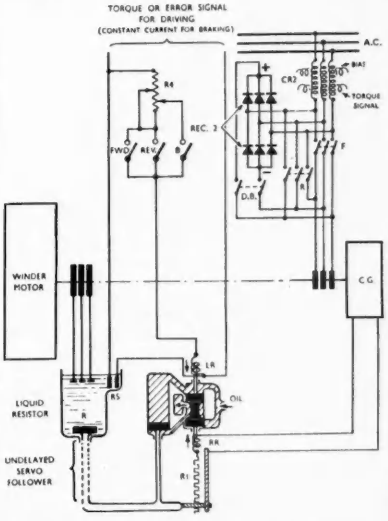


Fig. 1.—Basic circuit of the rotor control system

When dynamic braking is applied to an induction motor by exciting its stator with d.c. and dissipating the energy generated by the rotor in a resistor, various difficulties may arise. Under certain conditions the machine becomes unstable, and an increase of rotor speed results in reduced braking torque. Furthermore, the stator excitation may be too high, requiring unnecessary rotor resistance for a given torque and resulting in unnecessary heating. The present scheme takes full account of the electrical conditions in the rotor circuit during driving, braking or reverse-current braking, which must be satisfied to give optimum performance.

At a given excitation and speed the

maximum braking torque is developed when rotor circuit resistance equals speed times K_1 (a constant). A similar relationship for maximum torque when driving or plug-braking can be shown to be necessary at any given speed namely: rotor circuit resistance equals slip times K_2 (a constant). Thus by adjusting K_1 and K_2 the maximum, or any chosen torque, may be maintained at optimum conditions.

In the present scheme the resistance in the rotor circuit is varied automatically to satisfy the above conditions. This is done by a hydraulic servomechanism which automatically adjusts the resistance in the rotor circuit to the optimum value at all times. The rotor resistor may take the form either of metallic grids or a liquid controller.

Referring to Fig. 1, the rotor resistor R is varied by a hydraulic servomechanism, under the control of two opposing coils LR ("lower resistance") and RR ("raise resistance"). Coil LR is energized by a.c., the value being determined by the torque and speed signalling. When driving, this current varies with the speed error in a ratio of about 2 : 1; with dynamic braking, this current is constant.

Coil RR, which opposes LR, is fed from the stator or secondary winding of a control generator CG driven by the winder motor WM. Thus, at any given rotor or primary excitation of CG, the voltage across RR reflects that of the rotor of the main winder motor, and varies directly with the slip or speed.

The primary excitation of CG is derived from the controllable reactor CR2, which is controlled by the speed-error signal, so that for zero or small errors the excitation of RR is high and decreases with increasing error in speed; i.e., the greater the speed error the smaller the excitation of RR. This reduction is limited to a set value.

The total variation of driving torque is controlled by simultaneous variation of the LR current and the control generator voltage across RR, both of which are functions of the signal current but act in opposition. The control generator voltage can vary in a ratio of about 1 : 6 at any speed, which, together with the variation of 1 : 2 of the current in the LR coil, gives a total torque control ratio of 1 : 12. When dynamic braking is used, the same total torque control ratio is achieved with a constant current in coil LR, because the variation of torque with d.c. excitation is about 2 : 1. Thus the excitation control ratio of 1 : 6 is enough to give the required 1 : 12 total torque control ratio. Variation of coil LR excitation is kept to the minimum to ensure high sensitivity of the servo-regulator.

Also connected in the RR circuit is a variable resistor R_1, actuated by the servo-mechanism and arranged so that its value always reflects that of the rotor resistor R. As the frequency of the voltage V is that produced by the slip, it is very low at high speeds, and to avoid pulsation of the hydraulic servo-gear, the whole RR circuit is made two-phase. Since the temperature coefficient of the metallic resistor R_1 is small while that of the liquid resistor R is large, compensation must be made for the considerable variation in R with temperature. This is done by connecting a small fixed liquid resistor RS in parallel with coil LR. It is in a pocket in the liquid controller so it is subject to the same temperature variation as R.

If the driver's lever is moved from "stop" (by more than 25 per cent of its travel) a fixed maximum a.c. excitation appears in coil LR, while the control generator CG receives minimum excitation. Simultaneously coil RR is excited by the equivalent of the rotor standstill volts. At this instant coil RR is in series with the whole of R_1, so a small current passes, an equivalent small current passing through R in the rotor circuit of the winder motor. Under these conditions coil LR prevails and cuts out R_1 and R together. If the mechanical brake has not been released, a point is reached where the reduction in R_1 is such that the increase in the current in RR is sufficient to produce a pull which balances that of LR. The operating valve then closes and the motion of the servo-mechanism is arrested. The circuit resistances are such that at this instant the motor exerts maximum torque. If the brake be now released, the winder motor will accelerate, and both its slipring volts and equivalent voltage V from the control generator will fall. The current in RR is accordingly reduced, and LR again takes control and opens the operating valve. Thus the servo resumes its motion and R and R_1 are further reduced so that the pulls exerted by RR and LR are kept nearly in a state of balance.

From the foregoing it can be seen that

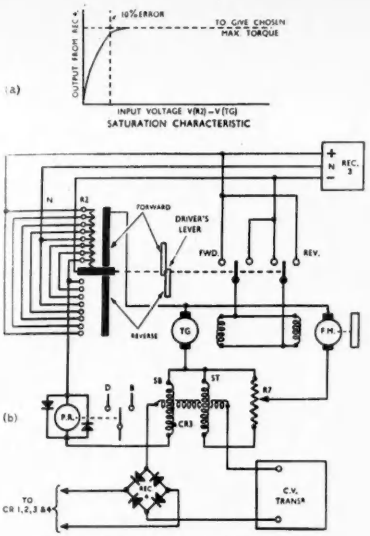


Fig. 2.—The speed signalling system

during acceleration the ampere-turns in LR equal the ampere-turns in RR plus the constant weight effect. Now ampere-turns in LR are constant during this period. The ampere-turns in RR will be nearly constant so that the current in RR will be nearly constant, i.e., $\frac{V}{R_1} = K$, or $R_1 = \frac{V}{K}$

but V = per cent slip × rotor standstill volts V_1 (a constant) so

$$R_1 = \frac{\text{per cent slip} \times V_1}{K}$$

or R_1 = slip × a constant K_2.

The rotor resistor R is proportional to R_1, just as the rotor voltage is proportional to V_1, and thus the fundamental requirement for constant torque performance ($R = K_2 \times$ slip) is fulfilled. This relationship holds good for any value of slip and therefore covers reverse-current braking. A similar argument may be developed for the conditions during dynamic braking, the only difference being that V equals speed times rotor volts at full speed and excitation. Hence R equals speed times a constant K_1.

Here K_1 varies with the d.c. excitation so the requirement for optimum braking performance with minimum excitation is met. The difference between K_2 and K_1 is effected (Fig. 1) by adjusting the resistor R_1 in the LR circuit.

During acceleration or deceleration the rotor resistor R is adjusted automatically to ensure maximum safe torque. As the required speed is approached, the speed-error signal diminishes, which increases the excitation of the control generator and hence its voltage V. The current in coil LR is also reduced. These changes alter the values of K_1 or K_2 to give the correct conditions for the motor at the torque demanded by the load. Variations in load during the wind will cause only a slight speed variation, but enough to adjust K_1 or K_2 to correspond.

The speed signalling system is shown in Fig. 2. At "stop" the driver's lever is in the middle of a "gate" and its first lateral movement selects the direction or rotation of the motor. Further movement in either slot actuates a d.c. potentiometer R_2, selecting a reference voltage which determines the final steady speed of the winder. This voltage is balanced against a voltage from the tachometer-generator TG through the speed-balancing winding SB of reactor CR3. This winding is in series with the polarized relay PR which determines whether the motor drives or brakes. Across TG is a small motor FM fitted with a flywheel, and connected in series with the stabilizing winding ST of CR3. Since the reference voltage does not reverse with the movement of the driver's lever through "off," provision is made whereby the lateral movement of this lever reverses the separately excited fields of TG and FM. If the reference voltage exceeds that of the tacho-generator, a current circulates through the speed-balancing winding SB of CR3 producing a corresponding output from the rectifier Rec. 4 which feeds the excitation circuits. At the same time the polarized relay PR sets up the circuits for driving. If the tacho-generator voltage exceeds the reference, a current in the opposite sense passes through SB and PR, and the latter relay sets up the circuits for braking.

R_2 is tapped so that a residual reference is still present in the "stop" position to give a brake signal down to zero tacho-generator voltage. This ensures that maximum dynamic braking is available down to the lowest possible speed.

As the motor accelerates or decelerates in response to a change in the reference voltage, the current through FM varies in proportion to the rate of change. This

current, circulating in winding ST of CR3, opposes the effect of the speed-balancing winding SB, thus providing the negative feedback necessary for stability. R7 enables this feedback to be adjusted.

The characteristics of CR3, combined with those of Rec. 4, are such that for a small difference between the reference and TG voltages the output from Rec. 4 is proportional to this difference, but for larger differences no further increase in output takes place (Fig. 2 (b)). The reactors energized from Rec. 4 are such that the maximum output of this rectifier corresponds to a pre-selected maximum torque from the motor.

To protect PR from excessive current without losing sensitivity, its main coil is shunted by two rectifiers which by-pass current so soon as the normal operating voltage of the relay is substantially exceeded. Two extra bias windings on this relay enable the operating voltage to be adjusted, and to differ for " driving " and " braking " and to compensate for the idling current of FM. These windings may be adjusted to prevent unnecessary changes from driving to braking, and thereby prevent unnecessary wear on the main contactors.

In the excitation system (Fig. 3) the output from Rec. 4 feeds the control windings of CR2 which are in series with those of CR1 (braking) and CR4 (driving). CR2 is associated with the a.c. excitation of CG when driving, or with its d.c. excitation through Rec. 2 when braking. CR1 is associated with Rec. 1 which supplies the braking d.c. excitation to the winder motor WM. CR4 controls the a.c. supply for the compensating resistor RS from which the excitation for coil LR is derived.

Sequence of Operations

The operation of the complete scheme (Fig. 4) can be understood by considering the sequences following various quick motions of the driver's lever.

(a) " *Stop* " *to* " *Half speed Forward.*" Movement through the gate immediately sets up control circuits for the " forward " direction. Further movement to the half-speed forward position causes the regulator R2 to apply 50 per cent of its maximum voltage to the speed-error signalling loop " TG–CR3 (SB)–PR " circuit. The current in winding SB saturates CR3 which produces its maximum output. At the same time PR closes contacts which set up the main contactor circuits for " driving."

Rec. 4, associated with CR3, also delivers its maximum output to the control windings of CR2 and CR4. As the control winding opposes the bias winding of CR2 the latter gives minimum output and hence minimum excitation of CG, which is connected directly to CR2 by the " forward " contactor.

As the control winding assists the bias winding BW of CR4, the output from the latter produces maximum excitation of LR of the hydraulic servomechanism. Thus the pull of LR is able to overcome that of RR and the motor accelerates at the chosen maximum torque. As the motor gathers speed the tacho-generator voltage rises, so the current in winding SB falls; no change takes place in the output from CR3 and Rec. 4, because CR3 remains saturated.

Acceleration continues at maximum torque until the speed approaches that selected, after which the output voltage of CR4 is rapidly reduced, causing the current in LR to fall and the excitation of CG to increase, until the torque of the winder motor equals the load torque.

As CR4 is excited by CR3 via Rec. 4, reduction in its output occurs a little earlier,

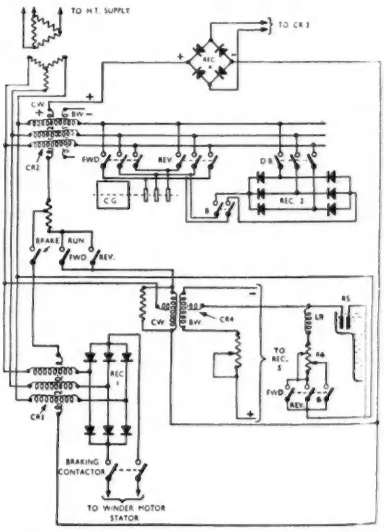


Fig. 3.—Schematic diagram of the excitation system

because the current taken by FM in accelerating with the rising voltage of TG, traverses the stabilizing winding ST of CR3. When this current diminishes with the acceleration of FM, a stabilizing effect is introduced which prevents any tendency for the speed to overshoot the selected value.

As the wind proceeds, the down-going load increases with the length of rope until, in the case of a deep wind, it will ultimately exceed the up-going load. In this event the speed will rise until it exceeds that set by the driver's lever, when the tacho-generator voltage will exceed the reference voltage, and the current in SB and PR will be reversed. The reversal of current in SB has no effect, because CR3 is non-directional and gives the same output for a given control current in either direction. PR, however, is polarized and changes over its contacts thus causing the main driving contactor to open and the main braking contactor to close.

As a result, the output from CR3 and Rec. 4 is transferred to CR1 and CR2, while CR4 receives constant excitation. CR1 now supplies increasing d.c. excitation to the stator of the motor until braking effort is sufficient to balance the down-going load. A slightly higher speed will be needed to maintain this condition. During this set of circumstances CR2 supplies d.c. excitation to CG which in turn feeds coil RR.

On entering the retarding zone, the driver's lever is moved back to reduce speed. The tacho-generator voltage then substantially exceeds the reference voltage and full braking excitation (limited by the reactor characteristics) is applied, so that maximum braking torque is developed. On reaching bank, the act of setting the mechanical brakes opens the dynamic braking contactor via the contact BC.

Regenerative Braking

(b) "*Stop*" *to* "*Full speed Forward.*" *Regenerative Braking.* Acceleration to full speed takes place at maximum torque, as described above. Assuming the wind is such that regenerative braking is possible, this will begin on a slight rise in speed above synchronism, R2 being set to permit the necessary increase without changing over to dynamic braking. On entering the retarding zone a backward movement of the driver's lever will cause PR to change over and initiate dynamic braking.

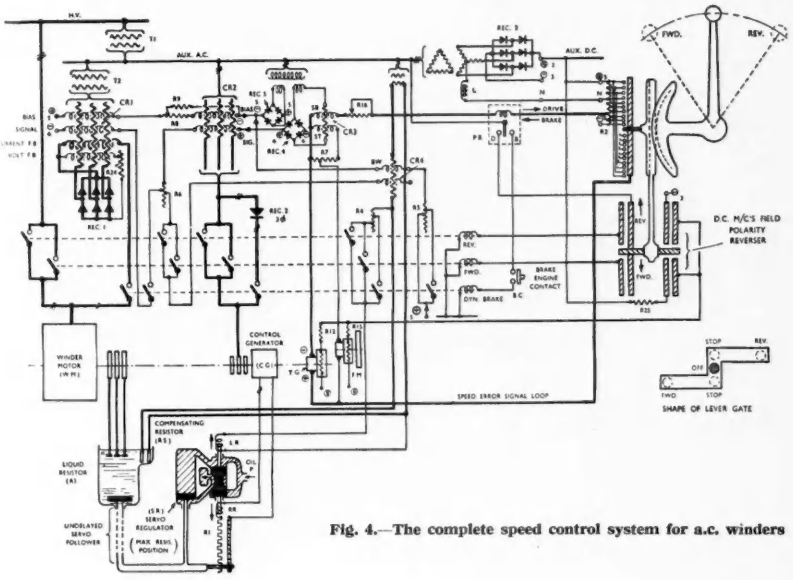


Fig. 4.—The complete speed control system for a.c. winders

(c) "*Full speed Forward*" *to* "*Full speed Reverse.*"—*Reverse-current Braking or Plugging.* The first movement of the driver's lever from "forward" toward "stop" initiates dynamic braking, since the reference speed will be less than the actual speed. When the lever passes through "stop" toward "reverse," the reference voltage increases once more in the same direction, but as the fields of TG and FM are reversed the reference and tacho-generator voltages are now additive. PR, therefore, maintains the "driving" circuits, and reverse-current braking is applied at maximum torque and under optimum conditions as described above.

An interlock circuit, omitted from the diagram, ensures that R and R_1 are at their maximum values before the "reverse" main contactor can close.

NEW BOOKS

Metadyne Statics. By J. M. Pestarini. Pp. 415; figs. 318; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 72s in U.K.

The author of this book is the undoubted inventor of the metadyne. His research work on d.c. machines was carried out in the 1920's when he was a Professor at the University of Rome. It took only ten years before every major country was designing and using metadynes for traction purposes.

This book is a methodical presentation of the author's life work on the theoretical development of the metadyne for traction purposes. The approach to the subject is extremely general in scope and considers arbitrary numbers and distribution of field windings and brushes. Steady state and quasi-static characteristics are dealt with throughout the book, which is divided into two parts; the first appertains to the general machine, and the second part deals with special cases and particular types of machines. Although the book tends to be theoretical, many details of practical installations are discussed such as the ship *Orlando*, Illinois Central Electric Railway, the Toulouse Trains, and the London Subway. Half of one chapter is devoted to the metadyne as an amplifier. Chapter 10, the last chapter in Part I, is devoted to commutation. This should be read by any person interested in d.c. machines.

Transient analysis and dynamic characteristics are not dealt with. For this reason the book will not appeal to control system engineers for whom the metadyne is only one important element of an overall system. The book will be welcomed, however, by metadyne machine designers and by students of advanced theoretical studies in the field of generalized d.c. machines.—J.C.W.

Modulators and Frequency Changers. By D. G. Tucker, pp. 232; figs. 115; index. MacDonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 28s.

This book is intended to provide communication engineers with data on the design and performance of frequency changers and modulators for use in low power circuits operating in the video frequency range. The opening chapters are devoted to the development of the theory of amplitude modulation and a description of the mode of operation of many of the circuit arrangements commonly used.

The characteristics of the non-linear elements used in modulator circuits are then discussed together with their effects on modulator performance. Much useful information on the stability and spread of the characteristics of modulating elements is given in this section.

The remaining chapters deal briefly with such topics as distortion, the effects of spurious signals in the carrier supply, and the use of negative feedback in modulator circuits. The rigorous mathematical analysis of non-linear circuits is necessarily complicated, and Dr. Tucker is to be complimented on his methods of attack which yield results useful to the engineer without undue mathematical complexity.

The only criticisms of this book are that the valve types of frequency changer, which are most commonly used in radio applications, merit more extensive treatment; and a more detailed index would have been useful.—H.B.W.

ELECTRICITY SUPPLY

Farm Supply Costs Criticized

Power Plant Construction in South Africa

AYSGARTH (Yorks) R.D.C. has decided to support a campaign by the Ripon and Pateley Bridge Council against high capital charges for supplying electricity to farms. Instances have been given to the Council where farmers were asked to contribute sums ranging from £300 to £650 for electricity supplies to their premises.

At a meeting of Hexham R.D.C. it was stated that in some other areas the charges to farmers were only a third of those of the North Eastern Electricity Board. One councillor alleged that private contractors could install the necessary cable, etc., for a supply at one-sixth of the Board's charges. Another councillor said that farmers were able to obtain grants for farm improvements and the installation of electricity should be included under this heading.

This matter was also referred to at a meeting of the North Riding Branch of the Rural District Councils' Association at Scarborough. Mr. F. N. Brown (Reeth) said the North Eastern Electricity Board had given him an estimate amounting to £625 for supplying his farm. It was decided to refer the matter to the Association's Executive Committee.

Cookers at Calne

The Housing Committee of the Calne and Chippenham Rural Council was asked to reconsider its decision regarding cookers in the Council's houses at a meeting of the Council on 31st August. The Committee had informed tenants at Neston that cookers and wash boilers could be provided only if an increase of 2s 3d was made in the rent. Electrical points are already provided.

It was the view of some members of the Council that a landlord had a duty to provide cooking facilities. Some of the Council houses were already equipped with cookers and an invidious situation had been created.

Immersion Heater Hire-Purchase

Since arrangements were made by the East Midlands Electricity Board for the installation of immersion heaters in Council houses under hire-purchase agreements Wigston (Leics.) U.D.C. has received a number of applications for permission to install heaters. The Council's engineer and surveyor has been instructed to approve applications, subject to the Board's making good "any disturbance, if and when the apparatus is removed."

Donegal Development

Plans have been approved for a 4,000 kW hydro-electric development on the River Clady, near Gweedore, Co. Donegal. It is expected that tenders will be invited by the Electricity Supply Board before the end of the year. Three lakes are involved in the project—Lough Nacung (Upper and Lower) and Lough Dunlewy. A control dam will be constructed between Lough Dunlewy and Upper Lough Nacung, and part of the flow of water emerging from Lower Lough Nacung will be diverted into a headrace canal. The catchment area of the whole scheme on the Clady is about 31 square miles. The famous Poisoned Glen, which overlooks the projected site, will not be affected.

Power from Natural Steam

The New Zealand Minister of Works (Mr. Goosman) announced in Wellington on 28th August that Messrs. Merz & McLellan had been asked to survey the Wairakei area and prepare a preliminary report on the exploitation of geothermal steam for the generation of electricity, together with an estimate of the cost of a steam power station with an initial capacity of 20,000 kW. He said that the consultants would also assist the Government engineers in examining a proposal to produce "heavy water."

South African Programme

The South African Electricity Supply Commission's programme of power station construction and extension involves a capital expenditure estimated at £91 million, according to the Commission's report for 1952. Last year a loan of $19·6 million was obtained from the Export-Import Bank of Washington to finance the cost of providing power for the production of uranium. From revised estimates of the cost of new power stations it appears that the average capital expenditure per kW is likely to be £66 compared with £15·3 in the case of the Klip station completed in 1942. The Commission considers it inevitable that there must

be an upward adjustment of tariffs, which will be substantial when all the new plant is brought into operation. Electricity sales last year amounted to 8,080 million kWh, an increase of 8 per cent. Load shedding was necessary on a number of occasions.

Orange River Scheme

The Durban Correspondent of *The Times* reports that at the opening of an agricultural congress in Pietermaritzburg on 2nd September, Sir John Le Rougetel, United Kingdom High Commissioner, foreshadowed a water conservation and hydro-electric scheme on the upper waters of the Orange River in Basutoland. The Orange and Senqunyane Rivers would be dammed at Seforung at which point and at smaller dams farther down the Orange River 150 MW of power could be developed.

Uganda Board's Headquarters

A design submitted by a Johannesburg architect, Mr. E. I. Graaf, has been selected for the Uganda Electricity Board's new five-storey headquarters in Kampala. It is estimated that the building will cost approximately £350,000. The building is to be shared with the Lint Marketing Board and the Uganda Development Corporation.

Netherlands Control Centre

The Netherlands Minister for Economic Affairs, Professor J. Zijlstra, recently opened a new main control centre near Arnhem for the Netherlands electricity supply. The centre controls the export and import of electricity between the Netherlands, Belgium and West Germany. Consumption in Holland has risen from 2,400 million kWh in 1938 to 6,500 million last year. A new power station has been opened at Dordrecht with a capacity at present of 200 MW; space has been provided for two more turbines which will raise the capacity to 300 MW.

Toronto Distribution Changes

Frequency standardization has had precedence over the other major project in Toronto—the placing of primary lines underground—during the past year. The Toronto Hydro Electric System was able to supply 13,200 V, 60 c/s service to twelve large consumers and the installation of a city-wide distribution system of 60 c/s at 120/240 V was initiated. By the end of 1952 the total load supplied at standard frequency in the area was 50,600 kW.

Some progress, nevertheless, was made with the underground construction programme at such times as when the widening of streets necessitated the moving of poles. During the year, 365,000ft of duct was laid, 93 manholes and seven transformer vaults built and 425,000ft of cable installed.

Last year 2,142·7 million kWh was sold, an increase of nearly 4 per cent. The report of the Commissioners points out that, while the disparity between plant capacity and load growth is being steadily overcome, the plant is still overloaded to the extent of about 23,500 kW.

Tariff Representations

Several matters relating to tariffs were reported to the Eastern Electricity Consultative Council at its meeting last Friday. It was stated that the Tariff Sub-Committee had considered representations on behalf of a firm of frozen food packers whose electrical demand was twice as high in the summer as in the winter and who contended that a special tariff should be offered. The Sub-Committee recommended that the Board should be asked to consider the quotation of special terms and also whether it might not be desirable to introduce a seasonal demand tariff for cases of this kind.

It was reported that the Associated Portland Cement Manufacturers had made further representations, feeling that the revised terms offered were still unsatisfactory. One of the main points concerned the fuel cost adjustment clause, a subject which was to be discussed with the Central Authority. Enfield Rolling Mills had also intimated that they would like to meet the Council again on the question of electricity charges.

Water Power in Luxembourg

Work is expected to begin at the end of this year on two hydro-electric power schemes in Luxembourg, one at Each-sur-Sûre and the other at Rosport. They will be the first developments of this kind in the Grand Duchy. The building costs are estimated at 340 million francs, of which 140 million francs (£1 million) is available from United States aid. The output of the plants is estimated at 16·3 million and 22·6 million kWh per annum, respectively. Power production in the Grand Duchy amounted to 831 million kWh last year, 814 million kWh being used within the country (88 per cent by heavy industries).

Street Scavenging

Ramsgate Corporation Works Committee has asked the borough engineer to prepare a scheme for the reorganization of the town's street scavenging by the use of electric orderly trucks.

Voltage Standardization

The North Eastern Electricity Board has announced that it is proposed to alter the three-phase supply at Richmond, Yorks, from 400 to 415 V and the single-phase supply from 230/460 to 240/480 V.

House Installations

Dalton (Lancs.) U.D.C. proposes to seek sanction to borrow £1,430 for the electrical wiring of pre-war Council houses.

Airport Radio Equipment

Experimental Mobile System

AN experimental mobile v.h.f. radio scheme which, if generally adopted, could alleviate many difficulties in the ground operations of the world's airports, has been installed recently by the Ministry of Civil Aviation at London Airport. The General Electric Co., Ltd., supplied the equipment for the experiment at the request of the Ministry. Essentially the equipment is a mobile extension of the airport telephone exchange which allows any subscriber on that exchange to keep in touch with a mobile vehicle, which may be up to ten miles away from the airport centre.

The amplitude modulation 10/12 v.h.f. transmitter-receiver installed in the rear of the vehicle operates from the vehicle battery. It can operate on frequencies between 70 and 180 Mc/s in certain specified bands including the frequency allocated to vehicles towing aircraft. It is arranged for duplex operation; that is to say, the caller in the vehicle treats the equipment as if it were an ordinary telephone extension and it is not necessary to depress a switch before the speaker can be heard by the subscriber at the other end. A separate control unit close to the driver and passengers incorporates a loudspeaker, control switch and volume control. In the airport building, an exchange matching unit connects an existing transmitter-receiver to the airport telephone exchange, thus allowing the extension of the exchange to a mobile subscriber. Associated with this unit is an indicator unit on the telephone exchange board. As an extension to the scheme, the fixed transmitter-receiver could be placed at any distance up to five miles from the telephone exchange itself, provided a line connection were available.

Supply in Belfast

ELECTRICITY sales in the Belfast Corporation's area of supply during the year ended 31st March last fell slightly below the level of the previous year. The main causes were reduced requirements by the shipyards and transport undertaking, representing a combined loss in sales of 5·5 million kWh. Industrial supplies were adversely affected by a recession in trade, but Mr. R. P. Watson, acting city electrical engineer and general manager, in his report adds that towards the end of the year there were signs of an improvement in the industrial sphere. Though total sales (374·2 million kWh) were lower, the maximum demand rose from 131·7 to 139 MW.

An additional 4,147 consumers were connected, making the total number 130,942. Supplies have continued to be provided to new housing estates and Mr. Watson remarks that in many instances electricity is being employed for all domestic purposes.

Distribution extensions last year comprised 25 miles of h.v. and 36½ miles of l.v. cables, 20 miles of service cables and 10¾ miles of overhead lines and services. Twenty-eight substations and kiosks were commissioned. During the year 2,448 supplies were changed over from d.c. to a.c.

A total of 409·9 million kWh was generated. Coal (245,747 tons) cost on an average 71s 7·232d a ton, equivalent to 1·343 lb per kWh generated, costing 0·515d. For the previous year the figures were 1·349 lb costing 0·477d. The average cost of coal at designated stations in Northern Ireland for 1952–53, on which the cost of generation is based, was 69s 10·929d.

Work on the extensions at the East power station, approved in December, 1948, was virtually completed. After initial delays caused by steel shortages and technical difficulties in placing the civil engineering contract for circulating water works, satisfactory progress has been made at the West power station. Site erection of the first 30 MW turbo-alternator should commence this autumn. Meanwhile, the Electricity Committee in January last approved extensions to the station, with a 60 MW set planned for commissioning before the winter of 1956–57 and a second set a year later.

The Department's accounts show a total revenue of £2,245,236 and a net surplus of £102,940. To meet rising costs tariffs were adjusted last autumn.

A.S.E.E. Competition

THE Executive Council of the Association of Supervising Electrical Engineers states that the Branch Merit Cup has been awarded to the Bournemouth Branch in the 1952–53 competition. This Branch gained the highest combined marks in the competition for the best all-round record of activities for the 1952–53 session, including attendance at meetings, percentage increase in membership and efficient management of branch affairs. South-East London (last year's winners) were placed second, and Nottingham third. The panel of adjudicators consisted of the national chairman, the vice-chairman, the hon. treasurer, and the chairman of the Organization Committee. The Cup will be presented to the Branch by the president of the Association, Mr. C. T. Melling, M.Sc.Tech., M.I.E.E., M.I.Mech.E., at the presidential address meeting to be held at the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, on 20th October.

Financial Section

STOCKS and SHARES

WITH little further change in the general level of gilt-edged prices, most of the past week's interesting movements have been connected with individual company news. In addition to the incidents mentioned below, mention may be made of a rise in Telegraph Condenser shares to 38s 9d after the decision to maintain the interim dividend at the same rate (5 per cent) as was paid before a recent capital bonus. British Thermostat have declared an increased interim dividend, but with the stated object of evening up the interim and final rates. Officially remaining at 16s 3d, the shares have changed hands at over 17s.

Brush Electrical Issue

Holders of the ordinary shares in the Brush Electrical Engineering Co. have now received their forms of application at par for the 940,000 new 6 per cent preference shares. These will be convertible at twice-yearly intervals until the end of 1963, at the rate of four 5s ordinary shares per £1 preference share, with 1s payable in cash for each ordinary share taken up. As the company's circular points out, this option has no value while the shares are at their present price, but could acquire it in the course of events. A market review underlines the potentialities in this respect by reference to the level at which earnings and dividends were running before the losses on Indian contracts marred the figures for 1952.

A. C. Cossor Capital

The 5s shares of A. C. Cossor have been off-colour, at about 8s 9d ex-dividend, since the news, contained in the annual report, of the proposal to create 2½ million new shares, and to issue at least a part of these at a favourable opportunity. The dividend for the past year is being maintained at 10 per cent and the chairman expresses reasonable confidence that it will be possible again to pay the same rate even on a larger capital. Turnover of the group rose by nearly £1½ million during the latest period, but with much of the increase ascribed to Government contracts, the trading profit comes out rather lower than before.

Rheostatic New Shares

Dealings began last week in the new preference and ordinary shares issued by the Rheostatic Co. to the respective classes of shareholders. Offered at par (10s), the 6 per cent preference shares started at a premium of 9d., while the 4s ordinary shares developed a premium of 2s 3d on the issue price of 8s. They are available free of transfer stamp, and, at the all-in price, the ordinary show a yield of nearly 7½ per cent on the basis of the 19 per cent dividend paid for last year. For the year ending this month, the interim payment was raised from 4½ to 7 per cent, with advice that this should not be taken as indicating a larger total; the final dividend is due next April. The record shows a consistent expansion of the business in recent years.

Hackbridge Cable Results

Hackbridge Cable Holdings 5s shares advanced to 12s 9d ex-dividend, about the best price recorded this year or last, following the disclosure, in the preliminary statement, of trading profits more than double those of the previous year. The rise of £225,000 is to a large extent drained away by a £155,000 increase in tax charges (which include £20,000 on account of the excess profits levy), but the net surplus of £157,000 is still £70,000 to the good. The ordinary dividend is being held at 20 per cent and appears to be covered thrice by the surplus.

Radio Share Yields

The occasion of the Radio Exhibition finds a number of the most popular investments in the field at around their best prices for twelve months or more. Interest in the market has been stimulated this year by the rise in the sale of television sets, and by some excellent company results, which included increased dividends from such prominent firms as Decca, Pye and E. K. Cole. Confidence in the outlook is reflected in the quotation of some of the shares on a yield basis comparable with the best in other sections of the industrial market. From the latest dividends, the yield is less than 5½ per cent on both Decca and Pye shares, and below 6 per cent on Cossors. Murphy shares give about 7¼ per cent, E.M.I. 8½ per cent and Ultra Electric over 9 per cent, at current prices.

Spectacular Rises

In a comparatively out-of-the-way section of the electrical market, attention is drawn to spectacular rises in the price of the Palestine Electric and Baghdad Light & Power issues. The former company's £1 "A" shares have risen in a month from 11s to 17s 6d, on hopes that new agreements with the local Government will lead to a resumption of dividends. A succession of sharp rises in Baghdad shares, now 60s 6d, have more than doubled the price lately. The movement springs from optimistic estimates of the "break-up" value in the event of nationalization of the undertaking.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 7th Sept. 1953	Week's Rise or Fall	Est. Yield £	Est. Yield s	Est. Yield d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	87	—	3	9	0
Brit. Elec. 1974/77	3	3	86	—	3	9	0
Brit. Elec. 1976/79	3½	3½	93	—	3	15	3
Brit. Elec. 1974/79	4½	4½	101	—	4	4	2
Calcutta Elec. ..	6†	6†	20/-	—	6	0	0†
East African Power	7	7	24/6	—	5	14	3
Nigerian Elec. ..	10	10	24/-	—	8	6	8
Palestine Elec. "A"	5†	Nil	17/6	+2/6		Nil	
Perak Hydro-Elec.	Nil	Nil	17/-	−6d		Nil	
Equipment and Manufacturing							
AberdareCables(5/-)	20	25	16/6	+3d	7	11	6
Aerialite (1/-) ..	83½	88½	8/9	—	10	1	10
Allen, W. H. ..	15	15	45/9	—	6	11	3
Aron Elec. Ord. ..	15	20	42/6	—	9	8	2
Assoc. Elec. Ord...	20	20	78/9	—	5	1	6
Automatic Tel. & El.	15	15	58/9xd	—	5	2	0
Babcock & Wilcox	18	18	66/6	—	5	8	5
Baldwin, H. J. (2/-)	20	20	4/-	—	10	0	0
Bakelite (10/-) ..	—	12½	19/-	—	6	11	6
British Aluminium	12	12	41/-	—	5	17	0
B.I. Callender's ..	9	10	37/-	—	5	8	1
British Thermostat (5/-)	30	35	16/3	—		—	
British Vac. Cleaner (5/-)	25	25	12/3	—	10	4	0
Brook Motors (10/-)	20	20	37/6	—	5	6	8
Brush Ord. (5/-) ..	10	4	4/-	—		—	
A. F. Bulgin (1/-)	30	30	2/10½	+1½d	10	8	6
Burco (5/-) ..	38½	35	18/3	—	9	13	0
Chloride El. Storage	15	20	78/9	—	5	1	0
Cole, E. K. (5/-) ..	25	25•	19/6	−3d	6	8	3
Cossor, A. C. (5/-)	Nil	10	8/9xd	−1/-	5	14	3
Crabtree (10/-) ..	17½	17½	29/-	—	6	0	8
Crompton Parkinson Ord. (5/-) ..	11½	11½	11/9	−3d	4	15	9
De La Rue (5/-) ..	35	Nil	8/6	—		—	
Decca (5/-) ..	112½	150	29/-	+1/6	5	3	9•
Dewhurst (2/-) ..	22½	19•	5/6	—	6	18	3
Dictograph Tel.(2/-)	20	20	5/6	—		—	
E.M.I. (10/-) ..	12	12	14/6	—	8	5	6
Electrical Components (5/-) ..	20	20	10/-	—	10	0	0
Elec. Construction	15	15	52/6	—	5	14	3
Enfield Cable Ord.	7½	5	21/3	—	4	14	0
English Electric ..	15	15	52/6	—	5	14	3
Ericsson Tel. (5/-)	22††	22•†	39/-	+6d	2	16	5†
Ever Ready (5/-)	35	35	26/6	+6d	6	12	1
Falk Stadelmann	15	15	42/3	+6d	7	2	0
G.E.C. Ord. ..	22½	11½•	37/6xd	—	6	0	0
General Cables (5/-)	30	30	16/3	—	9	4	8
Greenwood & Batley	15	17½	40/-	—	8	15	0
Hackbridge Hewittic (5/-)	20	20	12/9xd	+9d	7	17	0
Hackbridge Hewittic (5/-)	20	20	17/6	—	5	14	2
Hill Tel. Acc.(10/-)	10	10	10/-	—	10	0	0
Huntree (2/-) ..	12½	12½	4/-	—	6	5	0
Ilmleys (10/-) ..	20	10½•	17/6	—	6	0	0
Invisible Radiophane (5/-) ..	15	20•	12/6	—	8	0	0
Johnson & Phillips	15	15	53/-	—	5	13	2
Lancashire Dynamo	12½	12½•	42/6	—	5	17	8
Laurence, Scott(5/-)	15	15	12/9	—	5	17	8
London Elec. Wire	12½	15	60/9	—	4	18	8
J. Lucas	7½	9½	43/9	+2/6	4	3	10
Marryat & S. (2/-)	22½	22½	5/9	—	7	16	6
Mather & Platt ..	12½	15	50/6	+6d	5	19	0
Metal Industries ..	15	12•	40/3	—	5	19	5
Mid. Elec. Mfg. ..	15	15	58/3	—	5	2	9
Murex	15	15	54/6	−6d	5	10	1
Newman Ind. (2/-)	10	10	2/3	—	8	17	9
Oldham & Son (1/-)	35	17½•	2/6	—	7	0	0
Parnall (Yate) (5/-)	6	6	3/9	−1½d	8	0	0
Parsons, C. A. ..	10•	12½	70/-	—	3	11	5
Plessey (5/-) ..	22½	25	27/-	+9d	4	12	7
Pye Deferred (5/-)	18	20	19/3	+3d	5	4	0
Revo (10/-) ..	27½	27½	16/3	—		—	
Reyrolle	10•	12½	62/6	—	4	0	0
Scot. Cable (4/-) ..	32	20•	12/9	—	6	5	6
Siemens Ord. ..	10	10	35/6	—	5	12	8
Southern Areas ..	5	6	14/9	—	8	2	8
Strand Elec.(5/-)..	17½	17½	8/3	+6d	10	12	2
Sturtevant (5/-) ..	17½†	18·1•†	25/-	—	3	12	0
Sun Elec. ..	15	15	25/-	—	12	0	0
Switchgear & Cowans (5/-)	22½	22½	14/-	—	8	0	9
Taylor, T. (5/-) ..	20	25	20/-	—	6	5	0
T.C.C. (10/-) ..	20	20•	38/9	+1/9		—	
T.C. & M...	10	8½•	29/-	—	5	17	3
Telephone Mfg.(5/-)	10	10	7/6	—	6	13	4
Thorn. Elec. (5/-)	10	12½	11/-xd	—	5	13	8
Tube Investments	25	15•	61/-	—	4	18	4
Vactric (5/-) ..	Nil	Nil	7/6	—		Nil	
Veritys (5/-) ..	7½	10	4/6	—	11	2	2
Walsall Conduits (4/-)	70	70•	44/6xd	—	6	5	10
Ward & Goldstone (5/-)	45	45•	39/-	—	5	15	9
Watford (2/-) ..	25	25	8/-	—	6	5	0
Westinghouse Brake	14	15	57/6	—	5	4	2
West, Allen (5/-) ..	15	15	12/3	+3d	6	2	5
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord.	—	6	84½	—	7	2	0
Ord.	—	3¾	57½	—	6	10	5
Anglo-Portuguese	8	8	21/3	—	7	10	7
Brit. Elec. Traction: Def. Ord. (5/-) ..	25	35	29/-	—	6	0	8
Cable & Wireless: Ord.	8	8	135½	+1½	5	18	0
4% Loan ..	4	4	97	—	4	2	6
Calcutta Trams ..	6†	6†	20/-	—	6	0	0†
Cape Elec. Trams	5	5½	10/-xd	—	11	0	0
Marconi Marine ..	10	10	28/6	—	7	0	4
Oriental Tel. Ord.	16	16	70/6	—		—	
Telephone Props.	8	8	5½	—		—	
Tele. Rentals (5/-)	10	10•	9/3	—	5	8	1

* After capital bonus. † Dividends are paid free of income tax.

The above quotations are based upon the middle prices given in the Stock Exchange Daily Official List

REPORTS and DIVIDENDS

The Electric Furnace Co., Ltd., reports a consolidated trading profit for the year ended 31st March last of £185,738, as compared with £139,463 for the preceding year, to which is added dividends and interest on investments of £2,715. After meeting all charges, including £92,997 for taxation, the group net profit is £45,621 (against £52,085). To this is added £17,837 brought in, provision for depreciation of investments no longer required, £1,050, excess taxation provision of previous year, £346, and general reserve of subsidiaries re-credited to profit and loss account, £75,000, making a total available of £139,854. Of this £105,000 is to be placed to the general reserve of the holding company and £2,000 transferred to pension fund reserve. It is proposed to pay a final dividend of 4½ per cent on the preferred ordinary shares, (making 10 per cent for the year), and 7 per cent on the ordinary shares (making 12½ per cent). The balance carried forward is £22,997.

In his circulated statement, Mr. D. F. Campbell (chairman) says that it is the policy of the board to exploit British Commonwealth markets and it has decided to form a company in Canada, which will probably be called EFCO—Lindberg, Ltd., in association with well known Canadian and United States companies. The new company will be in a position to supply all classes of melting and heat treatment furnaces, either imported or built in Canada, as may be advisable. Of the companies in the EFCO group, the Electric Resistance Furnace Co., Ltd., has made the largest contribution of profit and orders continue to come in at a satisfactory rate. The Electro-Chemical Engineering Co., Ltd., has again had a successful year, especially in the export markets of Germany, Austria, Italy and Australia. In the metal melting field new ground has been broken by the introduction of normal frequency furnaces for special cast-irons, and by the completion of electrical duplex plant for the melting and casting of copper, consisting of arc and induction furnaces. Induction heating of non-ferrous and steel billets in normal and high-frequency fields has also been developed in their research and development works at Burton-on-Trent. EFCO Engineering Co., Ltd., has been formed to take over and operate the manufacturing works at Burton. A number of special machines have been developed for induction heat treatment of parts for the engineering industry, and facilities have been provided for heat treatment to companies who have ordered plant, pending delivery of their equipment.

Hackbridge Cable Holdings, Ltd.—The accounts for the year ended 31st March last show a consolidated trading profit of £403,354, as compared with £177,912 for the previous year, and after charging £246,047 (against £90,903) for taxation, the group net profit is £157,307 (£87,009), to which is added £3,505 brought in, making £160,812. It is proposed to pay a final ordinary dividend of 12½ per cent, again making 20 per cent for the year, and after retaining £97,086 of the profit in subsidiaries, the balance carried forward in the parent company in £3,116.

In his statement, Mr. C. I. Steen (chairman) says that as many important buyers are, for the present, restricting their purchases to a minimum, the company does not expect in the current year to reach the figures for 1952-53, but, as the demand for its products must expand, the directors look forward to the future with confidence.

George Cohen, Sons & Co., Ltd.—The accounts for the year ended 31st March last show a group trading profit of £1,740,392, as compared with £1,794,667 for the previous year, to which is added £24,368 income from investments, making £1,764,760. After meeting all charges, including £1,296,156 for taxation, the net profit attributable to the holding company is £451,728 (against £704,018). The ordinary dividend for the year is 12 per cent on capital as increased by a three-for-two scrip issue (against 26 per cent on the former capital). The balance carried forward is £79,030 (against £73,084 brought in).

In his circulated statement, Mr. C. M. Cohen (chairman and managing director), says that at nearly £22 million the turnover was almost 50 per cent greater than last year. Margins in their merchanting activities were severely cut during the year, due to increased competition, to the types of plant and materials which became available, and to rising costs. The high level of turnover was maintained until the end of the year but at that time several sections experienced a fall in demand and their trade has only recently shown signs of picking up. Mr. Cohen reviews the activities of the manufacturing plants within the group.

Belliss & Morcom, Ltd., in a preliminary statement, show a group profit for the year ended 31st March last of £62,275, as compared with £80,059 for 1951-52. This was struck after deducting £129,007 for taxation. It is proposed to pay a final dividend of 8½ per cent, making 12½ per cent, less tax, for the year. For the previous year the dividend was 12½ per cent, less tax, plus a special centenary bonus of 2½ per cent, not taxable.

The Telegraph Condenser Co., Ltd., is paying an interim dividend of 5 per cent (same) on a capital increased by a bonus issue in July.

The British Thermostat Co., Ltd., is paying an interim dividend of 7½ per cent (same) on ordinary capital increased by a 100 per cent script issue.

A. H. Hunt (Capacitors), Ltd., has declared an interim dividend of 7½ per cent (unchanged).

The Chloride Electrical Storage Co., Ltd., is paying an interim dividend on the ordinary stock, both "A" and "B," of 5 per cent (unchanged).

The British Oxygen Co., Ltd., is paying an interim dividend of 6 per cent (same) on increased capital.

Lancashire Dynamo Holdings, Ltd., has announced an unchanged interim dividend of 4 per cent.

Max Stone, Ltd.—Electric & General Industrial Trusts, Ltd., on behalf of the company, is offering to purchase the ordinary shares from ordinary shareholders at the price of 18s per 2s share, holders to retain the right to receive the final dividend for the year ended 30th June last.

New Companies

Four Cousins (Electrical Contractors), Ltd.—Registered 14th August. Capital £100. Directors: Sir Wm. N. Cayzer, Bt., Hon. Herbert R. Cayzer, B. G. S. Cayzer and Hon. Michael A. R. Cayzer, all directors of Cayzer Irvine & Co., Ltd., etc. Secretary: G. A. Glover. Regd. office: Royal Liver Building, Liverpool.

Sprayed Insulations, Ltd.—Registered 18th August. Capital £5,000. Manufacturers, processors and merchants of and dealers and workers in insulating compositions, materials and substances of all kinds, etc. Directors: E. J. Burcher, Industrial Powders, Ltd., and K. Wood. Secretary: P. J. Mayne. Regd. office: 5, Fenchurch Street, E.C.3.

F. Maddocks, Ltd.—Registered 24th August. Capital £1,000. To acquire the business of an electrical engineer carried on by F. A. Maddocks at Woodford, Ches, as "F. Maddocks." Directors: F. A. Maddocks (secretary), Mrs. Beatrice G. Maddocks and R. G. Broome. Regd. office: 127, Moor Lane, Woodford, Ches.

Increases of Capital

Electroflo Meters Co., Ltd.—Increased by £50,000, in 10s ordinary shares, beyond the registered capital of £121,000. At 29th June, 1953, Republic Flow Meters Co., of Chicago, held 121,000 shares out of 242,000 shares issued. This company was allotted a further 50,000 shares out of 100,000 shares allotted on 11th August, 1953.

Haddon Transformers, Ltd.—Increased by £4,500, in £1 ordinary shares, beyond the registered capital of £500.

Northern Welding Co. (Northampton), Ltd.—Increased by £3,000, in £1 ordinary shares, beyond the registered capital of £2,000.

Solartron Laboratory Instruments, Ltd.—Increased by £25,000, in £1 shares, beyond the registered capital of £25,000.

Revo Electric Co., Ltd.—Increased by £750,000, in 10s ordinary shares, beyond the registered capital of £500,000.

Liquidation

Radio Television Research Finance Corporation, Ltd.—Particulars of claims by 30th September to the joint liquidator, Mr. R. A. Rodgers, 25, Bedford Row, London, W.C.1.

Bankruptcies

J. F. Thompson and **H. A. Why**, lately trading and carrying on business in co-partnership under the style of Southern Radio TV Electrical Services, at 52, Wellington Mews, Hastings, electricians.—Receiving order made 28th August on debtors' own petition.

E. Vasey, 21, Bridge Road, Bishopthorpe, York, electrician.—First meeting held 10th September. Public examination 22nd October at the Law Courts, Clifford Street, York.

R. H. Myers, trading as "T. Myers & Son," at, 169, Aston Road, Birmingham, 6, gas and electrical engineer.—Trustee, Mr. R. F. Bendall, 126, Colemore Row, Birmingham, 3, released 21st July, 1953.

R. W. Scott, 159, Bromley Road, Catford, London, S.E.6, lately carrying on business at 44, Market Parade, Rye Lane, Peckham, S.E.25, as Bromley Ignition Co., electrician.—Receiving order made 31st August on debtor's own petition.

G. R. Rosvall, engineer and electrician, lately carrying on business at the Corner House, St. Giles, Torrington, Devon.—First meeting 15th September at the Official Receiver's office, 26, Baldwin Street, Bristol. Public examination 6th October at the Guildhall, Barnstaple.

S. D. Bennett, 2, Burnt Ash Parade, Lee, London.—Order made 30th July, 1953, granting bankrupt's discharge subject to his consenting to judgment being entered against him for the sum of £50. The sum of £50 was paid to the Official Receiver on 1st August in lieu of entering up judgment.

STREET LIGHTING NOTES

OLDBURY Town Council is to improve the lighting from Buckley crossing to the West Bromwich boundary; Prescott Street to Five Ways, Langley; Station Road–Dog Kennel Lane to Queen's Road, Warley, roundabout; Green Street, Bank Road to Rood End and Vicarage Road to Crosswells Road–Dog Kennel Lane junction.

COVENTRY City Council is informing private housing estate developers that they will be required to meet the cost of providing means of street lighting to Group B standard as part of any development for which planning permission is granted.

LONG BUCKBY (Northants) Parish Council has accepted an estimate by the East Midlands Electricity Board for converting the street lighting from gas to electricity.

HINCKLEY U.D.C. proposes to erect twelve 250 W mercury vapour street lamps from the end of Ashby Road to Barwell Lane.

Improved street lighting in BROMLEY (Kent) has brought praise from the local busmen's branch of the Transport and General Workers' Union, which has asked the Council to extend the scheme to other busy traffic roads in the town.

PADDINGTON Works Committee recommends the acceptance of the revised tenders of North Midland Engineering Co., Ltd., for conversion from gas to electric street lighting in the streets included in the 1953–54 programme as follows:—Supply and erection of concrete columns, £4,758; supply and installation of lighting equipment using G.E.C. sodium lanterns, £4,489; and removal of the gas columns, provision of new electric connections and mains extensions, time switches, reinstatements, etc., £13,490.

Bulk replacement of lamps is to be tried for twelve months by SOUTHEND Lighting Committee, instead of the present method of changing them when burned out. It is felt this should afford a much improved street lighting service, although adding £500 to maintenance costs initially.

The cost of lighting all Class I roads in the city by electricity instead of gas, including maintenance, is being examined by HEREFORD Corporation.

A £5,985 scheme being considered by BUXTON Borough Council embraces the improvement of street lighting over a large part of the town.

For the lighting of Hill Street, Richmond, Surrey, Revo C.13740 wall-mounting fittings for 5ft fluorescent tubular lamps are used. The fittings are mounted 25ft high with a spacing of 50ft (staggered). Thirty-four fittings were used, the installation being carried out by the South Eastern Electricity Board

Training for Management

MUCH stress is laid nowadays on the importance of ensuring a supply of properly-qualified people for managing industrial, commercial and other undertakings and many individuals are anxious to equip themselves for the purpose. Accordingly it is useful to have available such a guide as that just published by the British Institute of Management, 8, Hill St., London, W.1 (" Education and Training in the Field of Management," price 7s 6d). This sets out in more or less detail the facilities offered by universities, and technical and commercial colleges all over the country. Brief particulars are given of degree and diploma courses at universities in the various subjects entering into the science of management.

There follows a section showing the colleges which prepare students for the examinations of recognized bodies in the field of management. Another section surveys the post-graduate courses available. The third part of the volume contains a review of the syllabuses for the examinations of the British Institute of Management, the Institute of Industrial Administration and other interested bodies, concluding with specimen papers.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 21st October, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

5791. Atkinson, W. O.—Stanchions, beams, roof girders, masts, electric transmission towers and like supports. 23rd March, 1950. (698794.)

8232. Siemens-Reiniger-Werke Akt.-Ges.—Ultrasonic energy conductors. 25th March, 1949. (698795.)

23410. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Electrostatic precipitator apparatus. 9th September, 1949. (698796.)

32993. General Electric Co., Ltd.—Cathode-ray tubes. 13th March, 1951. (698799.)

1950

9785. Drayton Regulator & Instrument Co., Ltd., and Grover, R. V.—Electrical control apparatus. 20th July, 1951. (698615.)

10591. Rushworth, D.—Method of supplying electric or fluid power to an electrically or fluid-driven reciprocating carriage and/or apparatus mounted thereon. 8th June, 1951. Cognate application 1565, 20th January, 1951. (698616.)

10944. M.-O. Valve Co., Ltd., and Wright, D. A.—Thermionic valves. 2nd May, 1951. (698675.)

11164. Standard Telephones & Cables, Ltd.—Selection system for electrical circuits or equipments. 5th May, 1950. (698802.)

12480. British Thomson-Houston Co., Ltd.—Plasticized vinyl halide resins and electrical conductors insulated therewith. 18th May, 1950. (698618.)

14222. General Electric Co., Ltd., and Brablam, H. B. S.—Apparatus for use with cathode-ray tubes. 7th June, 1951. (698678.)

14925. Derby Cables, Ltd.—Manufacture of electric cables. 15th June, 1950. Addition to 644530. (698545.)

16074. Premier Electric Heaters, Ltd.—Thermostatically controlled switches for electrically heated appliances. 24th September, 1951. (698619.)

20835. Murgatroyd, W., and Trefethen, L. M.—Pumps for electrically-conducting liquids. 3rd September, 1951. (698623.)

24007. Lenze, W., sen., Lenze, E., jun., Lenze, W., jun., and Lenze, F. (trading as Lenze Kommandit-Ges., W.).—Electrical strip lighting arrangements. 2nd October, 1950. (698683.)

27694. Metropolitan-Vickers Electrical Co., Ltd.—A.c. protective gear of the current balance type. 9th November, 1951. (698686.)

27695. General Electric Co., Ltd., Bryden, J. E., and Baster, B.—Voltage stabilizing apparatus. 13th November, 1951. (698687.)

28610. Whipp & Bourne, Ltd.—Air-break electric switch-fuse assemblies. 21st November, 1951. (698688.)

29931. Pye, Ltd.—Television transmitting apparatus. 6th December, 1951. (698551.)

30373. Rheostatic Co., Ltd.—Electric thermostats. 18th October, 1951. (698552.)

31281. Standard Telephones & Cables, Ltd.—Electric-discharge tubes and circuit arrangements therefor. 22nd December, 1950. (698812.)

1951

180. English Electric Co., Ltd.—Flameproof housing assemblies. 21st December, 1951. (698813.)

1078. British Thomson-Houston Co., Ltd.—Phase-shifting circuits. 15th January, 1951. (698635.)

1307. North Midlands Engineering Co., Ltd.—Supporting straps for cables or other elongated articles. 17th January, 1952. (698696.)

1851. Siemens & General Electric Railway Signal Co., Ltd., Field, R. W. G., and Mott, J. E.—Remote control and/or indication systems. 24th January, 1952. (698816.)

3506. Newton Victor, Ltd.—X-ray tube anode assemblies. 6th December, 1951. (698817.)

3577. Philips Electrical Industries, Ltd.—Magnetically anisotropic permanent magnets and methods of manufacturing such magnets. 14th February, 1951. (698638.)

6127. Horstmann Gear Co.—Small synchronous electric motors of the permanently-magnetized rotor type. 7th March, 1952. (698565.)

6829. Hallam, Sleigh & Cheston, Ltd.—Combined circuit breaking means for electrical apparatus and catch-releasing or unlocking means for the cabinets containing same. 29th April, 1952. (698567.)

7116. Munro & Miller, Ltd.—Electrically pre-heating pipes and flanges therefor. 27th February, 1952. (698820.)

7221. Telephone Manufacturing Co., Ltd.—Snap-action electric switches. 24th March, 1952. Cognate application 24262, 17th October, 1951. (698821.)

9503. British Thomson-Houston Co., Ltd.—Adhesion of phosphor powders to the glass envelopes of fluorescent lamps. 11th January, 1952. (698826.)

10377. General Electric Co., Ltd., Cole, W. P., and Benjamin, S.—Mountings for electronic valves. 5th May, 1952. (698705.)

10815. Eutectic Welding Alloys Co., Ltd.—Welding electrodes. 8th May, 1951. (698829.)

11351/2. Philips Electrical Industries, Ltd.—Pulse-code modulation signal transmitters. 15th May, 1951. (698706/7.) 11353. Devices for separating synchronization and signal pulses in pulse-code modulation systems. 15th May, 1951. (698708.)

11358. Sangamo Weston, Ltd.—Electrical servo mechanisms. 15th May, 1951. (698569.)

11930. Russ, L., Russ, L., and Russ, E. (trading as Russ-Elektroofen Kommandit-Ges.).—Low-frequency induction furnaces. 22nd May, 1951. (698830.)

12435. Hope & Sons, Ltd., H.—Electric limit switches. 26th May, 1952. (698642.)

13564. Soc. d'Electronique et de Automatisme.—Apparatus for converting an electrical representation of a number from the binary to the denary scale of notation. 7th June, 1951. (698834.)

17964. Armstrong Siddeley Motors, Ltd.—Electrical heating and mounting of axial-flow compressor blades. 4th July, 1952. Cognate application 28101, 30th November, 1951. (698774.)

18184. Electric & Musical Industries, Ltd.—Recording of television pictures on film. 31st July, 1952. Addition to 650879. (698574.)

19410. Herbert, Ltd., A.—Dual-switch control means for starting machines. 17th August, 1951. (698579.)

20284. Metropolitan-Vickers Electrical Co., Ltd.—Protective electrical sparkover devices. 28th August, 1951. (698582.)

20506. British Thomson-Houston Co., Ltd.—Electric incandescent lamps and similar devices. 30th August, 1951. (698840.)

21295. Metropolitan-Vickers Electrical Co., Ltd.—Electric sparkover protective devices. 10th September, 1951. (698583.)

21883. British Thomson-Houston Co., Ltd.—Asymmetrically conductive devices. 18th September, 1951. (698585.)

22663. Ateliers de Constructions Electriques de Charleroi.—Radio electric teleprinter systems. 28th September, 1951. (698587.)

22754. Minister of Supply.—Static electricity eliminators. 26th September, 1952. (698779.)

24975. Westinghouse Electric International Co.—High-frequency switching devices. 25th October, 1951. (698591.)

25645. Thurber, jun., A. E.—Electric control means for hydraulic elevators. 2nd November, 1951. (698650.)

25932. Philips Electrical Industries, Ltd.—Automatic gain-control circuit arrangements in television receivers. 6th November, 1951. (698715.)

26141. General Motors Corporation.—Manufacture of insulated rings. 8th November, 1951. (698716.)

28162. British Thomson-Houston Co., Ltd.—Apparatus for separating charged particles of different mass-to-charge ratios. 30th November, 1951. (698850.)

29606. Igranic Electric Co., Ltd.—Control systems for induction motors. 18th December, 1951. (698594.)

30195. Balteau, M. J. F. J.—Device for switching on a transformer for a short time interval. 27th December, 1951. (698595.)

1952

118. General Motors Corporation.—Thermally responsive electric switches. 20th January, 1952. (698851.)

242. Brush Development Co.—Cylindrical twister-type electromechanical device. 3rd January, 1952. (698852.)

2495. Philips Electrical Industries, Ltd.—Electric discharge tubes. 30th January, 1952. (698853.)

3345. Allmanna Svenska Elektriska Aktiebolaget.—High-tension air-blast electric circuit breaker. 8th February, 1952. (698598.)

3742. Magnasca, Ltd., and Hansen, F.—Devices for providing and adjusting the connection between an electrostatic generator and an apparatus to be fed from said generator. 12th February, 1952. (698854.)

4655. Philips Electrical Industries, Ltd.—Cathode-ray tubes. 21st February, 1952. (698856.)

4774. Hoover, Ltd.—Suction cleaners. 22nd February, 1952. (698723.)

5345. Westinghouse Electric International Co.—Electron-discharge devices. 29th February, 1952. (698857.)

11117. Macfarlane, J. W., and Macfarlane, W. I.—Dynamo-electric generators. 2nd May, 1952. (698655.)

18338/40. Telegraph Condenser Co., Ltd.—Tubular containers for electrical condensers or other apparatus. 21st July, 1952. Addition to 584379. (698606/8.)

18598. Westinghouse Electric International Co.—Refrigeration apparatus. 23rd July, 1952. (698668.)

18723. Hoover, Ltd.—Suction cleaners. 24th July, 1952. (698669.)

18966. General Motors Corporation.—Refrigerator. 28th July, 1952. (698670.)

PORTUGAL'S EXPANDING MARKET

FEATURES last year of Portugal's expanding market for electrical goods generally were increases in imports of radio material and telephone apparatus, especially complete installations for exchanges in which Britain enjoyed nearly all the business. The only noteworthy decrease was in the lamp import trade. Values in 1952 of some of the chief electrical groups are shown in the table below, together with the principal countries of supply. Germany's progress in nearly every line was remarkable. (80 escudos = £1.)

Class of Equipment	1952 Esc.(000)	Inc. or dec. on 1951 Esc.(000)
Accumulators and condensers ..	7,408	+ 356
From France	504	— 331
„ United States	1,557	— 446
„ Germany	1,926	+ 943
„ Great Britain	2,993	— 626
Batteries, dry	1,316	+ 512
From United States	214	— 2
„ Great Britain	464	+ 224
„ Germany	487	+ 225
Vacuum cleaners	5,641	+ 571
From Sweden	2,222	+ 49
„ Great Britain	1,764	+ 949
Radio receivers	51,745	+ 3,750
„ Germany	15,255	+ 6,876
„ Netherlands	14,852	— 8,387
„ Great Britain	8,486	+ 1,546
Loudspeakers	2,223	+ 422
From Netherlands	616	+ 30
„ Great Britain	445	+ 93
„ United States	361	+ 14
Insulated wire or cable, textile covered, weighing up to 120 gr per metre	2,248	+ 473
From Great Britain ..	1,609	+ 186
„ Germany	351	+ 250
„ United States	210	+ 53
Ditto, weighing over 120 gr ..	822	+ 95
From Great Britain	420	+ 67
„ Germany	154	+ 73
Ditto, with other insulation and metal protected, up to 1,500 gr ..	6,454	+ 478
From Great Britain	2,378	— 1
„ Germany	1,482	+ 977
„ Belgium	1,144	+ 756
„ France	1,016	— 492
Ditto, with other insulation and metal protected, over 1,500 gr ..	29,818	+ 338
From Great Britain	17,315	+ 3,266
„ Germany	2,413	+ 238
Lamps, filament, for lighting ..	7,179	— 2,034
From United States	327	— 1,056
„ Netherlands	3,457	— 2,283
„ Germany	1,602	+ 867
„ Great Britain	712	+ 146
Lamps, other, for lighting ..	1,416	— 1,809
From Netherlands	520	— 1,140
„ United States	489	— 628
„ Great Britain	133	+ 3
Lamps, other electric	1,189	+ 61
From United States	434	— 16
„ Netherlands	280	+ 50
„ Great Britain	122	— 58
Generators, motors, transformers and parts weighing up to 100 kg ..	9,867	+ 2,289
From United States	1,591	+ 799
„ Great Britain	4,664	+ 1,658
„ Germany	1,627	+ 493
Ditto, weighing 100 to 500 kg ..	2,948	+ 389
From Great Britain	1,096	+ 612
„ France	337	+ 134
„ Germany	560	+ 22
Complete installations for telephone exchanges (not including telephones, accumulators or dynamos)	33,500	+ 3,354
From Great Britain	33,204	+ 4,351
„ Germany	126	+ 86
Telephone apparatus and parts ..	7,019	+ 1,504
From Great Britain	5,688	+ 1,126
„ Sweden	393	+ 3

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — BRISBANE. — 20th November. City Council. Supply of 11 kV switchgear and h.r.c. fuses. (E.S.B. 2850/53. Ten/7025.)*

Belfast.—17th September. Additions and modifications to electrical installation in new cinema and art rooms at Euston Street Senior Primary School. Education architect, Education Offices, 40, Academy Street.

Buckinghamshire.—County Education Committee. Electrical equipment for High Wycombe College for Further Education. (See this issue.)

Down.—24th September. County Education Committee. Electrical installation at new primary school. Ballylesson, Co. Down. Ostick & Williams, architects, 12-14, Corporation Street, Belfast.

Formosa.—TAIPEI.—29th September. Central Trust of China. Three 300 kVA transformers and associated electrical equipment. (E.S.B. 2642/53. Ten/7029.)* 30th September. 200 electric fans and a portable electric drill. (E.S.B. 2644/53. Ten/7035.)* Electric wire. (E.S.B. 2682/53. Ten/7018.)* Telephones and switchboards. (E.S.B. 2249/53. Ten/7008.)* 1st October. 21,500 incandescent lamps. (E.S.B. 2820/53. Ten/7040.)* Electric meter and testing equipment. (E.S.B. 2883/53. Ten/7058.)*

Haslemere.—10th October. U.D.C. Duplicating pumps, complete with motors and switchgear, at Shottermill Sewage Works. C. A. Best, surveyor, Council Offices, Museum Hill.

India. — NEW DELHI. — 28th September. Directorate General of Supplies and Disposals. Electric cables. (E.S.B. 2888/53 and E.S.B. 2889/53. Ten/7021.)*

BOMBAY.—15th October. Municipal Council. Sixteen 500 kVA transformers and four 250 kVA transformers. (E.S.B. 2887/53. Ten/7028.)*

Iraq.—BAGDAD.—15th September. Ministry of Finance. Ceiling fans. (E.S.B. 2941/53. Ten/7022.)*

New Zealand.—AUCKLAND.—25th September. Auckland Electric Power Board. Three 2,000 kVA transformers. (E.S.B. 2620/53. Ten/7024.)*

WELLINGTON.—20th October. G.P.O. Supply of receiving valves and germanium crystal diodes. (E.S.B. 2553/53. Ten/7031.)* 21st October. Telephone cable. (E.S.B. 3205/53. Ten/7053.)*

20th October. State Hydro-Electric Department. Five 3-phase 110 kV 2,500 MVA circuit breakers for Otahuhu substation. (E.S.B. 2625/53. Ten/7027.)*

Pakistan. — KARACHI. — 22nd September. Government Department of Supply and Development. Conductors, wires and accessories. (E.S.B. 3171/53. Ten/7050.)*

South Africa.—JOHANNESBURG.—17th September. South African Railways. Train lighting dynamos and auxiliaries. (E.S.B. 2596/53. Ten/7031.)*

Syria. — DAMASCUS. — Posts, Telegraphs and Telephones Department. Supply of radio telephone equipment. (E.S.B. 2102/53. Ten/6951.)*

Uruguay. — MONTEVIDEO. — 30th September. Usinas Electricas y los Telefonos del Estado. Electricity meters and spares. (E.S.B. 2661/53. Ten/7034.)*

9th October. Administracion de Ferrocarriles del Estado. Supply of 10,000 dry cells. (E.S.B. 3188/53. Ten/7055.)*

Walsall.—24th September. Town Council. Substation equipment. R. Edgley Cox, general manager and engineer, Transport Department, St. Paul's Street.

ORDERS PLACED

Heston and Isleworth.—Borough Council Works Committee. Recommended. Installation of improved street lighting in Staines Road from the Regal Cinema to Barrack Road (£4,608).—North Midlands Engineering Co., Ltd.

Newcastle-on-Tyne. — Education Committee. Electrical installation in the new School of Art and Industrial Design (£1,255).—Electra (Birmingham 1935), Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldridge.—Houses (150), at Pelsall; C. Andreason, U.D.C. surveyor, Daw End, Rushall, near Walsall.

Barrow-in-Furness. — Erection of North Walney County Infants' & Junior Schools (1954 programme); borough engineer.

Bath.—Dwellings (62), Fox Hill estate; city planning officer.

*Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Bingley.—Houses (59), Cottingley, Cullinworth and Wilsden; U.D.C. surveyor, Town Hall.

Birmingham. — New stores buildings at Acock's Green for Rover Car Co., Ltd.; C. Bryant & Son, Ltd., 65, Whitmore Road.

Houses (46), Blakesley estate, Yardley, 26 houses and flats in Church Road, Northfield, 12 flats in Bennett Street, Lozells, and 24 flats in Aston Hall Road; H. J. Manzoni, city engineer, Civic Centre.

Birtley.—Factory; Samuel Talbot (Engineers), Ltd., Fourth Avenue, Team Valley, Gateshead-on-Tyne.

Blackpool.—Erection of new St. Wilfrid's C. of E. School; Grenfell Baines & Hargreaves, architects, 12, Guildhall Street, Preston.

Boston. — Preliminary plans for proposed abattoir; borough surveyor.

Burgess Hill (Sussex). — Houses (44), Woodleigh Road site; F. E. R. Hogg, U.D.C. surveyor, 32, Church Road.

Bury St. Edmunds.—Additional wing at Alexandra Home; West Suffolk county architect, Westgate Street.

Cheadle (Staffs). — Ambulance station; county architect, Stafford.

Craghead.—Extensions to factory for Webwear (Stanley), Ltd. (£30,000); North Eastern Trading Estates, Gateshead.

Dorchester. — Dwellings (143), Poundbury; borough housing architect.

Downham Market. — Two schools for Norfolk E.C.; H. C. Greengrass & Sons, Ltd., builders, 58, Pitt Street, Norwich.

Ebbw Vale.—Out-patients' and X-ray department at Hospital; Wales Regional Hospital Board, Cathays Park, Cardiff.

Edmonton.—Casualty department (£30,000), North Middlesex Hospital; North West Metropolitan Regional Hospital Board, 11, Portland Place, W.1.

Ellesmere Port.—Houses (126), Seymour Drive estate, Overpool; U.D.C. surveyor, Queen Street Offices.

Enfield.—Flats (72), Manor Farm site; F. Lee, U.D.C. surveyor, 7, Little Park Gardens.

Halifax.—Bus station, Cross Field (£30,000); borough engineer.

Library and art room wing, J. H. Whitley Secondary School; borough engineer.

Hornsey.—Flats (30), at Sydney Road, and six flats and seven houses at Wightman Road by Fairfax Road; borough surveyor, Town Hall, Hornsey, N.8.

Keswick. — Houses (41), Latrigg Close; U.D.C. surveyor.

Leeds.—Rayon technology department for University of Leeds; J. Gerrard & Sons, Ltd., builders, Swinton, Manchester.

Liverpool. — Office and store building for Scottish Life Assurance Co., Ltd.; Sir A. E. Shennan, architect, 17, North John Street, Liverpool.

London. — CITY. — Office block, Bridewell Place; Trollope & Colls, Ltd., 41/44, Great Queen Street, W.C.2.

CLAPHAM.—Factory; W. Woodward, Ltd., 51, Clapham Road, S.W.9.

ROTHERHITHE.—Cold store extension; Chambers Wharf & Cold Stores, Ltd., Llewellyn Street, S.E.16.

Manchester.—Motor showroom and offices at Deansgate and Cumberland Street for Lookers, Ltd.; Neodox, Ltd., 7, Brazennose Street, Manchester.

Newbury. — Offices, Pembroke Road, for Ministry of National Insurance; W. E. Chivers & Sons, Ltd., builders, Devizes.

Newcastle-on-Tyne. — Two secondary schools north of Slatyford Lane and south of Dewley Road; city architect, 18, Cloth Market.

Nottingham.—Drill Hall, Wigman Road; Notts T. & A.F. Association, 6, Clinton Terrace, Derby Road.

Pershore.—New buildings for Institute of Horticulture; Wheeler & Mansell, Ltd., builders, Lime Street, Evesham.

Poole.—Houses (440), at Alderney West; borough surveyor, Municipal Buildings.

Preston.—Sports stadium, Hudsons Brow, London Road; borough surveyor.

Richmond (Yorks). — Ambulance station with flat and two houses (£11,270); county architect, County Hall, Northallerton.

St. Leonards-on-Sea.—Showroom and flats, 24, Grand Parade; S. Horsler, 19, Grand Parade.

Scarborough.—Coach station at Westwood for East Yorkshire Motor Services, Ltd.; Gelder & Kitchen, architects, 120, Alfred Gelder Street, Hull.

Scunthorpe.—Shops and flats, Ashby High Street; J. R. Heslam, Heslam House, High Street.

Stalybridge.—Library, Millbrook; Howard & Benson, architects, 88, Mosley Street, Manchester.

Stanley (Co. Durham).—Bus garage at New Kyo for Armstrong Omnibus Co., Ltd., Ebchester.

Stonehouse.—Secondary modern school, for Gloucestershire E.C.; county architect, Shire Hall, Gloucester.

Sunderland.—Conversion of "Grindon Close" into library and museum (£15,000); borough architect, Grange House, Stockton Road.

Surbiton.—Factory extension; U.K. Plastics, Ltd., Hook Rise, Kingston By-pass, Surrey.

Thornaby-on-Tees. — Primary school (£56,000); county architect, County Hall, Northallerton.

Towcester. — Houses, Blisworth (22) and Cosgrove (34) for R.D.C.; Council's architect, Towcester, Northants.

West Hartlepool. — Four-storey flats in central area of the town; borough architect, Municipal Buildings, West Hartlepool.

Whitehaven. — Clinic, chest centre and health offices; Cumberland Health Committee, Portland Square, Carlisle.